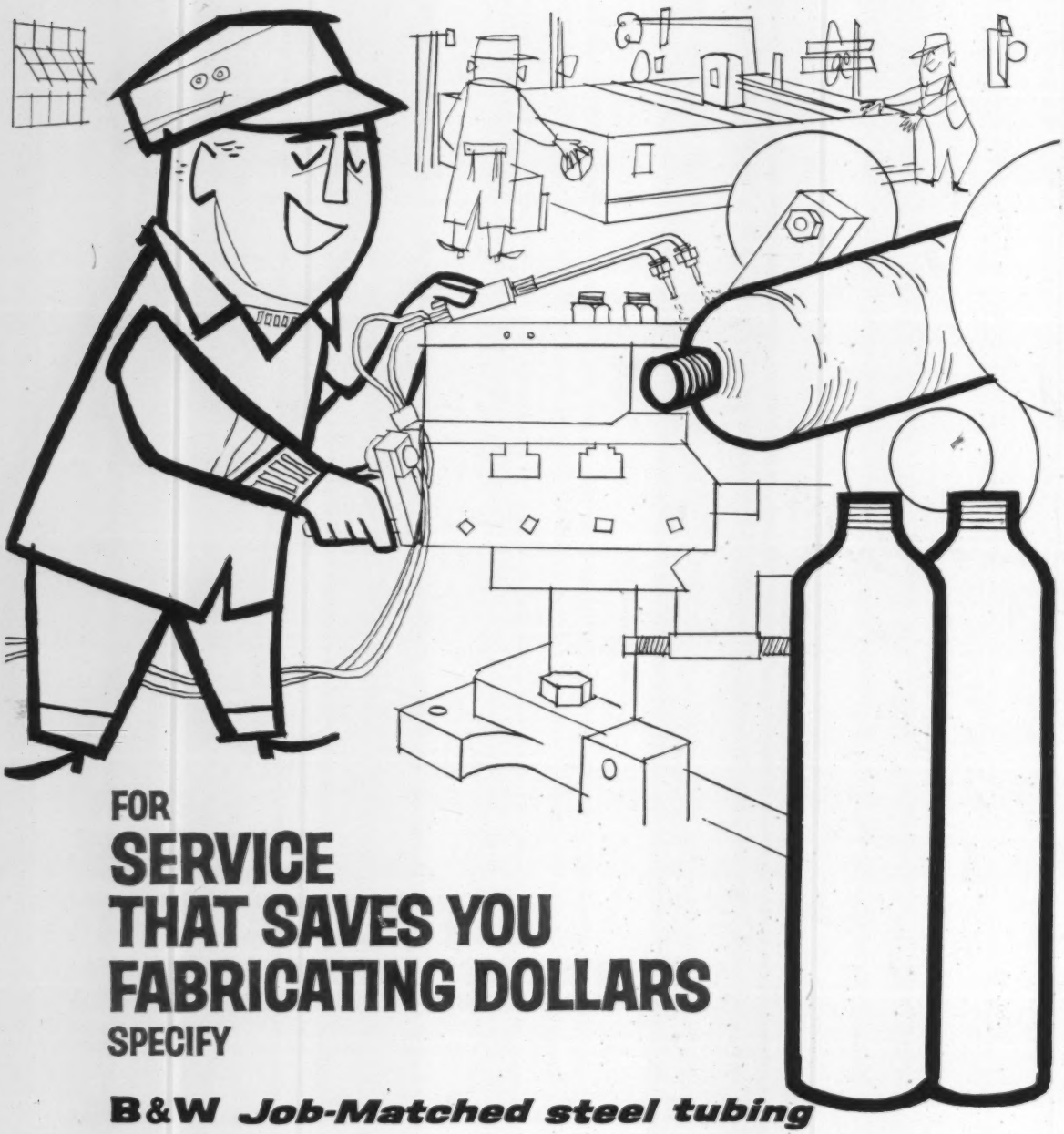
STEEL
The Metalworking Weekly
A PENTON PUBLICATION
JANUARY 2, 1961

1961 METALWORKING YEARBOOK ISSUE

PEOPLE POWER

Revitalize Your People Power 89
Your Most Wasted Resource 93
Make It Your Strongest Asset 117
1961 Forum on Technical Progress . . 141

METALWORKING WEEK—PAGE 17
COMPLETE CONTENTS—PAGE 19



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Steel

B&W

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A grade for every job

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Steel

For strength . . . economy . . . versatility

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BETHLEHEM STEEL

BETHLEHEM STEEL

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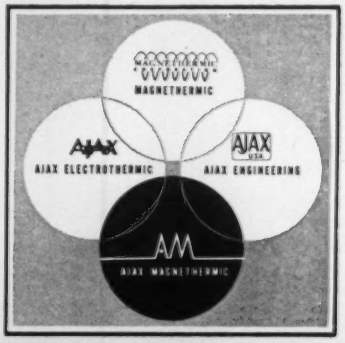
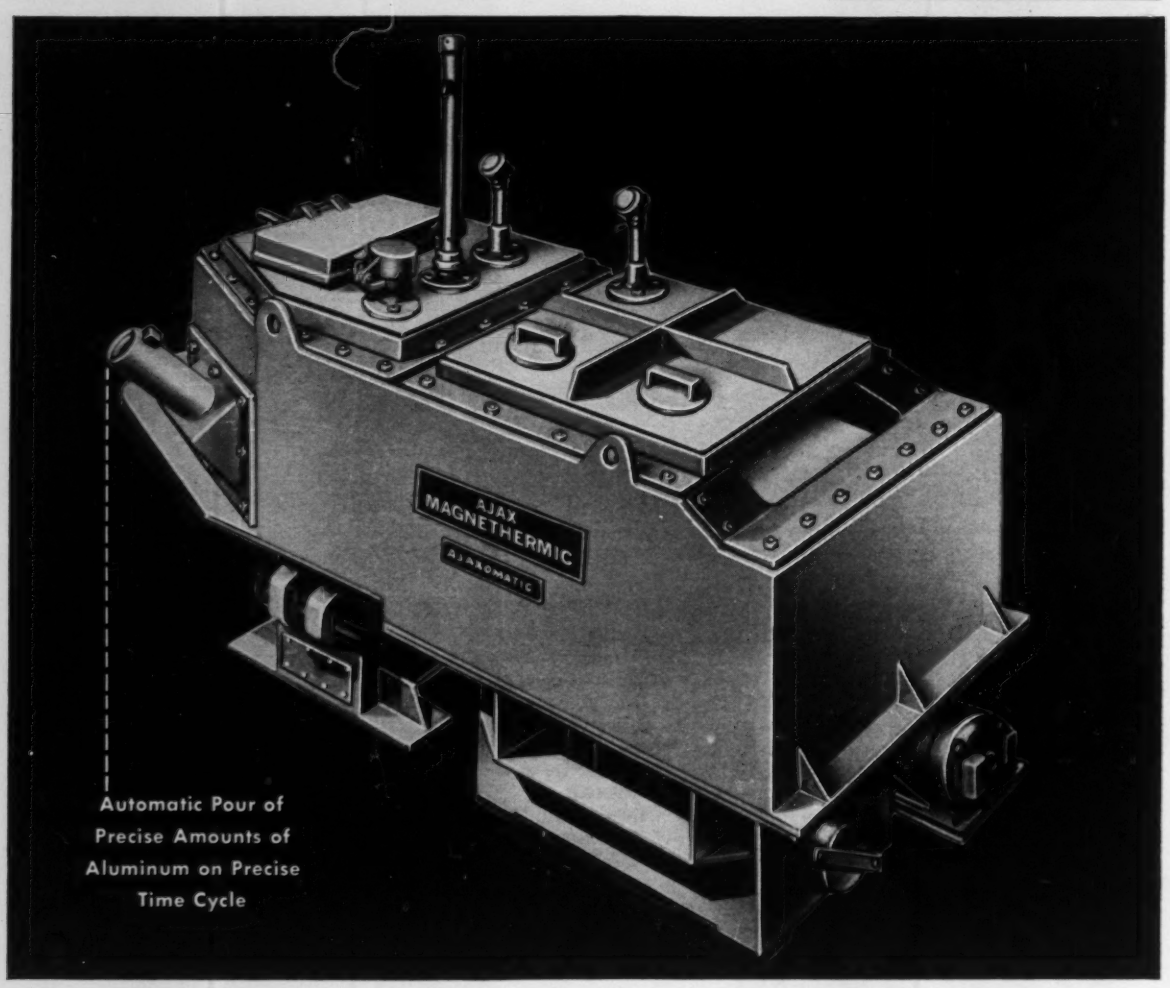
Use: Whenever high speed, high casting weight or high quantity requirements make hand ladling too slow or too costly. *How:* Ajaxomatic (60-cycle core type induction furnace) automatically supplies molten aluminum to the machine in any size "shot" on precise time cycle. *Experience:* There are many Ajaxomatics in use. Some of the largest die castings produced are poured with Ajaxomatic. *Inquiry:* Write direct to us for additional information on Ajaxomatic Automatic Pouring Furnace by induction.





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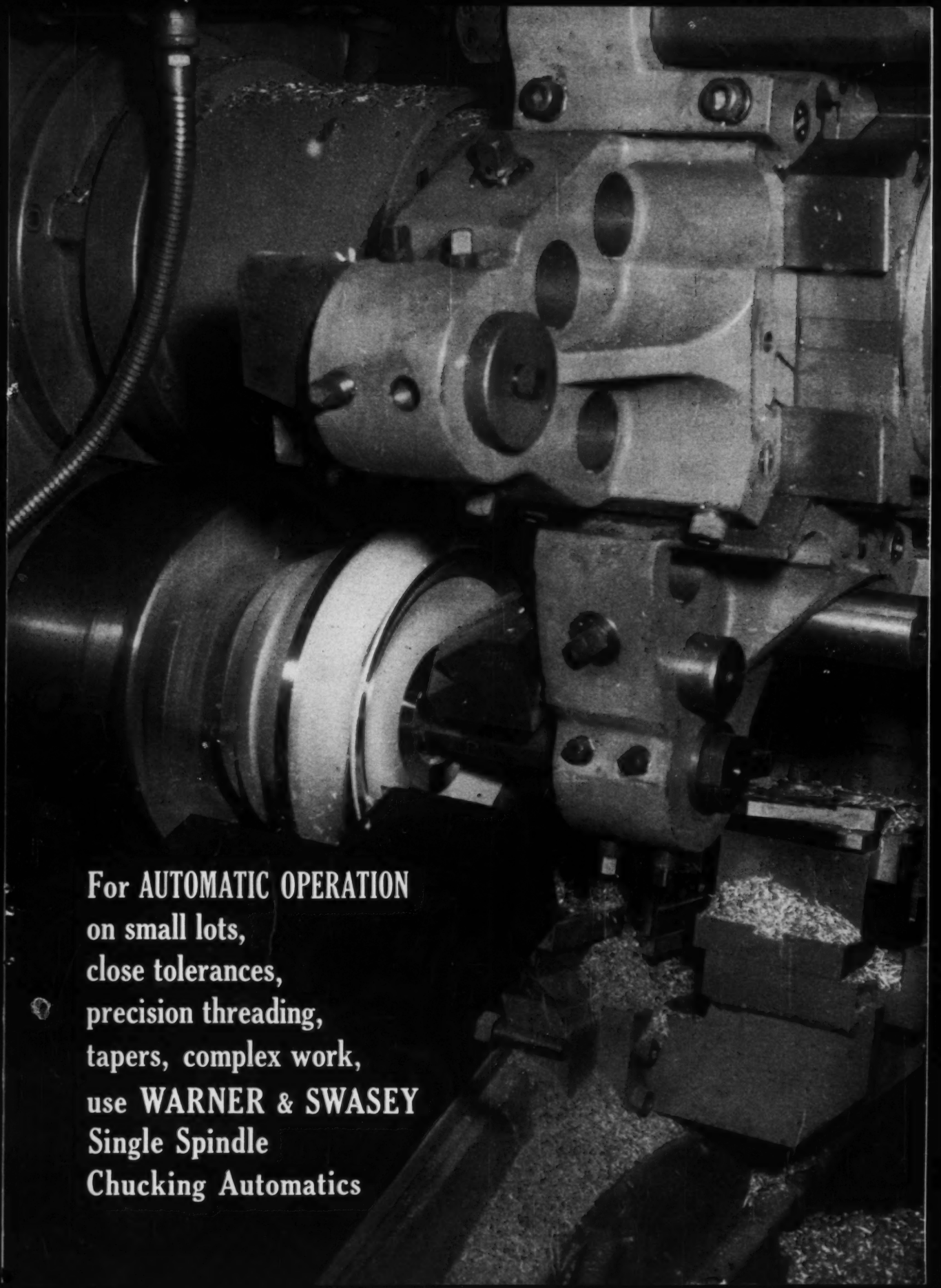
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close tolerances,
precision threading,
tapers, complex work,
use WARNER & SWASEY
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Your 2 factors in steel costs...

Steel is a low-cost material. But when you tie up your money in it, store it, insure it, pay taxes on it, buy equipment to handle it, cut and burn it—you often add unnecessarily to this low cost. And the big question is whether you or your nearby steel service center should perform these functions. The wisest thing to do is to find out.

Each steel user's case is different. Your steel service center will be glad to help you determine the most economical way to buy steel. Figure all your costs of possession, such as:

Cost of capital:	Cost of operation:	Other costs:
Inventory	Space	Obsolescence
Space	Materials handling	Insurance
Equipment	Cutting & burning	Taxes
	Scrap & wastage	Accounting

Call your steel service center, or write for free booklet, "What's Your Real Cost of Possession for Steel?"

STEEL SERVICE CENTER INSTITUTE

...YOUR STEEL SERVICE CENTER

STEEL SERVICE CENTER INSTITUTE
540-A Terminal Tower, Cleveland 13, Ohio

Steel

Changes for the New Year

If someone were to ask us: "What's new this week?" we'd be hard put to recall everything. Let's start up front. Our cover has a new, distinctive design. (We'll pause while you look . . . Back again? O.K.) The canary insert headed "This Week in STEEL," formerly tucked between the inside front cover and Page 1, is no more. The summaries of major articles are now in our Metalworking Week section as is the Table of Contents. The Metalworking Week insert has been moved to a new position. It now starts on Page 17.

This department, the Servicenter, is sole occupant of Page 5. The part that dripped over to Page 6 is replaced by our masthead.

$500 Went to . . .

. . . Harold C. Talling, sales manager, Urick Foundry Co., Erie, Pa., for his entry in our October Usership Idea of the Month Contest.

In his prize winning entry, he said:

"Long believers in visual education, we at Urick Foundry have used both 35 mm and Polaroid cameras extensively to picture our operations and products for customers and prospects. The Oct. 3 article, '15 Ways Photography Pays Off,' really challenged our thinking. As a result, we have come up with two ideas for operational applications which we feel will not only show important savings, but will give us even tighter controls over our iron melting operation.

"At his station, our melting foreman, Dave Regan (shown snapping picture), has a large blackboard on which he records all of the pertinent information concerning each ladle of iron that is poured. Each day, it was necessary for him to transfer all of the information to his permanent records. It took at least a half hour every day. We now photograph the blackboard with a Polaroid camera. In a matter of minutes, all information is in a permanent record, with no chance of an error in transcribing . . ."

A Record for Honorable Mention . . .

. . . awards was established in the October contest. Thirteen readers received handsome desk lighters, three more than in any previous contest. Their names: Robert P. Bozzone, assistant to works manager, Allegheny Ludlum Steel Corp., Leechburg, Pa.; William N. Brinker, director of public relations, Institute of Scrap Iron & Steel Inc., Washington; E. L. Harman, specialist, industrial engineering, and R. L. Shollenberger, engineer, materials, standards engineering, Steam Div., Westinghouse Electric Corp., Lester, Pa.; Norman J. Kaye, plant production controlman, Buffalo (N.Y.) Stamping Plant, Ford Motor Co.; A. R. Leist, plant superintendent, O. M. Edwards Co. Inc., Syracuse, N. Y.; Karl W. Matthes, manager, facilities and development engineering, Kaiser Steel Corp., Oakland, Calif.; R. J. Martin, chief engineer, Oster Mfg. Co., Cleveland; M. M. Mitchell, job and salary analyst, Personnel Dept., Tyler Pipe & Foundry Co., Tyler, Tex.; Frank Muhly, production control engineer, Production Dept., Cochrane Corp., Philadelphia; William Novak, tool and die design, Ceco Steel Products Corp., Chicago; E. T. Simons, project engineer, Lexington Road Photographic Laboratory, North Carolina Works, Western Electric Co., Winston-Salem, N. C.; Annaleah R. Warner, Metallurgical Dept., Columbia-Geneva Steel Div., Geneva Works, U. S. Steel Corp., Provo, Utah.

Five Weeks to Closing . . .

The final contest, covering December, 1960, issues, closes Feb. 1, 1961. You have five weeks to tell us, in 300 words or less, how you plan to USE articles or advertisements in December issues that will help you accomplish an important personal or company objective. If, in the opinion of the judges, yours is the best idea submitted—you will win $500.

You will win an additional $500 if you furnish written proof that you accomplished your objective. Proof must be submitted within six months after you are declared winner of STEEL's Usership Idea of the Month award.

All letters become STEEL's property. Send your entries to me, Ed Service, Servicenter, STEEL, 1213 W. Third St., Cleveland 13, Ohio.

• *Bound reprints of the study on People Power (beginning Page 89) are available at $2 a single copy; prices for larger quantities on request. Write Reprint Dept., STEEL, Penton Bldg., Cleveland 13, Ohio.*

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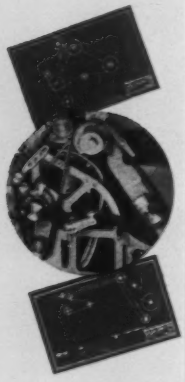
From your Roller Chain Dollar?

In engineering service and delivery from the manufacturer

Each dollar invested in Acme Chain buys the highest quality product that experience, material, design, craftsmanship and facilities can produce at competitive prices. But your dollar value doesn't end here. Acme has built its enviable reputation for giving its customers fast excellent engineering and technical service from start to finish.



Whatever the problem, Acme's Engineering Department has always been on hand to supply its customers with a fast practical solution.

Be sure you get this extra value from every dollar you invest in roller chains. Consult your nearest Acme Distributor or write our Engineering Department for the answer to your power transmission or conveying problems.

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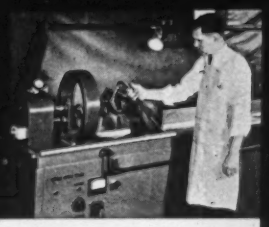

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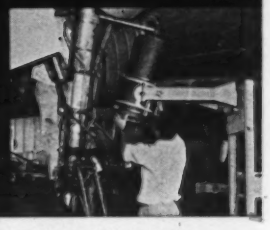

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In today's highly competitive market more and more manufacturers are turning to nondestructive testing as a sure means of improving their profit picture.

One manufacturer credits Sperry Ultrasonic test equipment with being directly responsible for increasing volume a full 20%. And it has enabled him to efficiently compete for orders in fields demanding the utmost in quality and reliability.

To get the most profitable results from nondestructive testing, call on Sperry Products Engineers for proper evaluation of your quality control problem.

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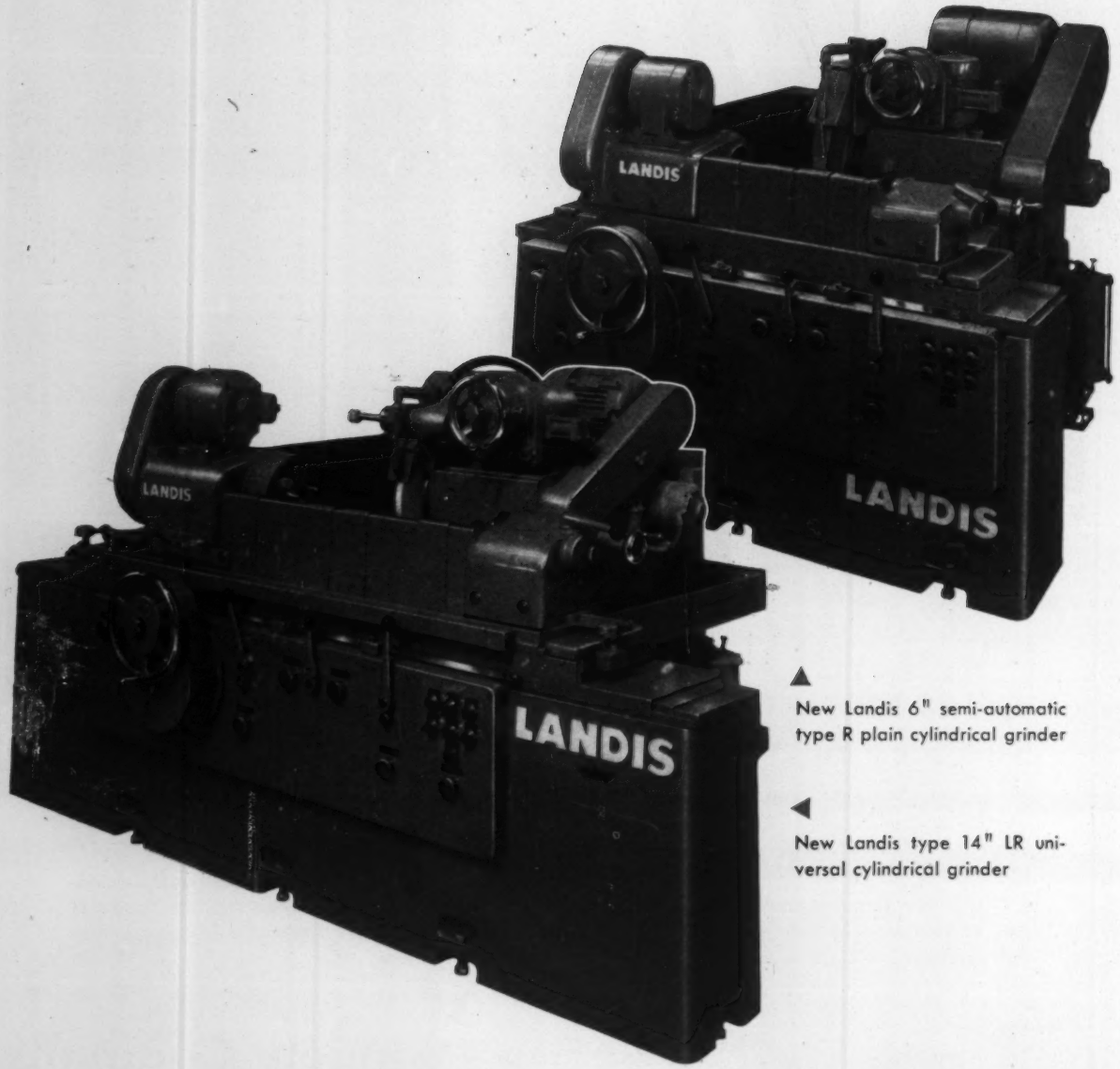

▲ New Landis 6" semi-automatic type R plain cylindrical grinder

◀ New Landis type 14" LR universal cylindrical grinder

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a major breakthru in size control—available on these machines

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precision grinders

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FROM START TO FINISH

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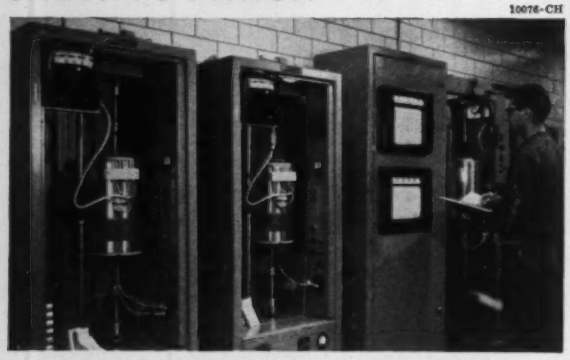

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'61 Convention Season Will Be a Busy One

New York City and Detroit will host some of the top conventions of the 1961 industrial exposition season.

The American Welding Society will hold its annual convention and exhibit in New York, Apr. 17-21, at the Commodore Hotel and the Coliseum.

Two shows will be running at the same time in May:

Detroit's Cobo Hall will be the scene of the Design Engineering Conference & Show May 22-25. **The American Society of Mechanical Engineers** is the sponsor.

In New York, the **American Society of Tool and Manufacturing Engineers**, Detroit, will hold its annual convention and exhibit May 22-26 at the Statler-Hilton Hotel and the Coliseum.

The **American Society for Metals**, Novelty, Ohio, will sponsor the 43rd National Metal Congress & Exposition at Cobo Hall, Detroit. Dates: Oct. 23-27.

Other key meetings during the year include:

Society of Automotive Engineers Inc.—Cobo Hall, Detroit, Jan. 9-13.

American Iron & Steel Institute—Waldorf-Astoria Hotel, New York, May 24-25.

Cutting Tool Manufacturers Association—Harmonie Club, Detroit, Feb. 23.

National Screw Machine Products Association—Somerset Hotel, Boston, Apr. 30-May 3.

National Association of Purchasing Agents — Conrad Hilton Hotel, Chicago, June 4-7.

American Society for Testing Materials—Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-30.

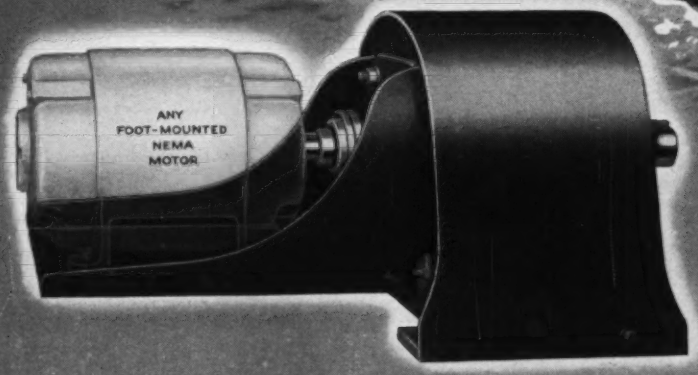
National Management Association—Sherman Hotel, Chicago, Oct. 23-27.

• **New Halls**—Two, giant exhibition halls opened during the waning months of last year (McCormick Place, Chicago, and Cobo Hall, Detroit) will be widely used this year.

For a more extensive list of 1961 meeting and conventions, please turn to Page 271.

FALK

A GOOD NAME IN INDUSTRY



20,000 hp at 100 rpm

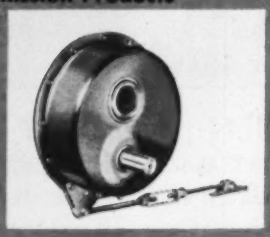
...or 75 hp at 100 rpm

THE FALK *ALL-STEEL*, ALL-MOTOR MOTOREDUCER
(also available in integral models)

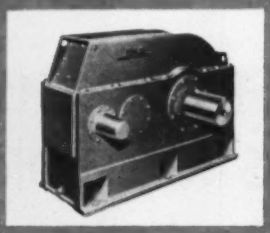
...one of America's First Family of Power Transmission Products

Other Members:

SHAFT MOUNTED DRIVES
—up to 125 hp. Ask for Bulletin 7100. Also Flange Mounted and Screw Conveyor Drives.



SPEED REDUCERS
Parallel Shaft up to 3500 hp. Ask for Bulletin 1100. Also Right Angle and Concentric Shaft designs.



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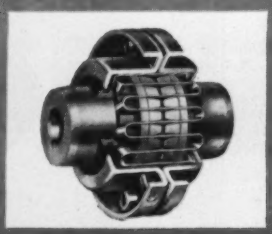
All-steel, torsionally resilient. 34 sizes, from .3 to 130,000 hp at 100 rpm. Ask for Bulletin 4100.



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Falk, producer of millions of horsepower of marine propulsion drives for nearly fifty years, has been continuously adding to its gear making experience and techniques—and applying the results to all products, standard drives as well as large special units, with the same full respect for the importance of accuracy. Today's versatile All-Steel Motoreducer is a striking example of the application of these attitudes and skills in producing the many standard gear units used throughout your own industry.

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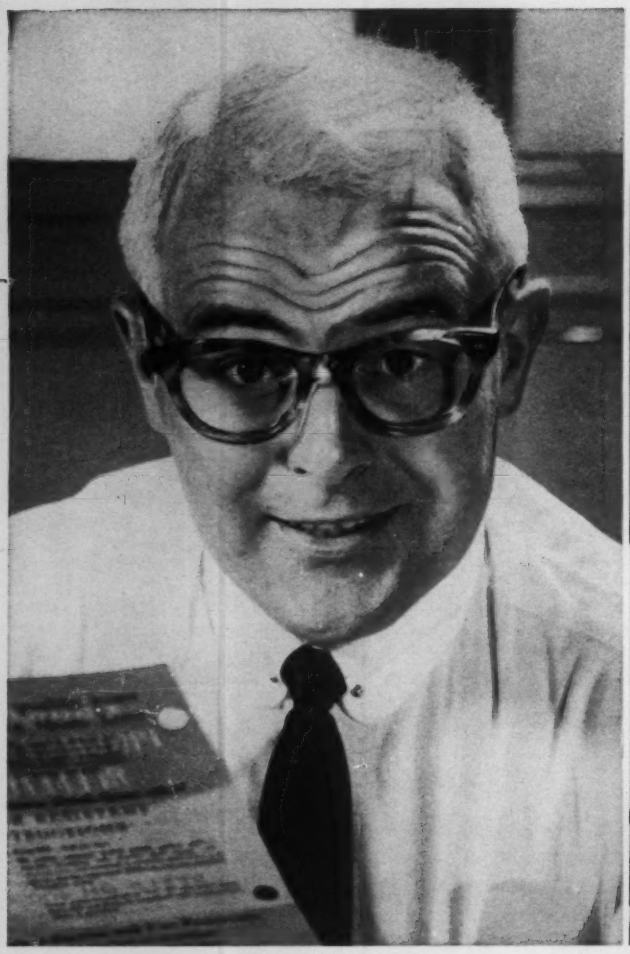
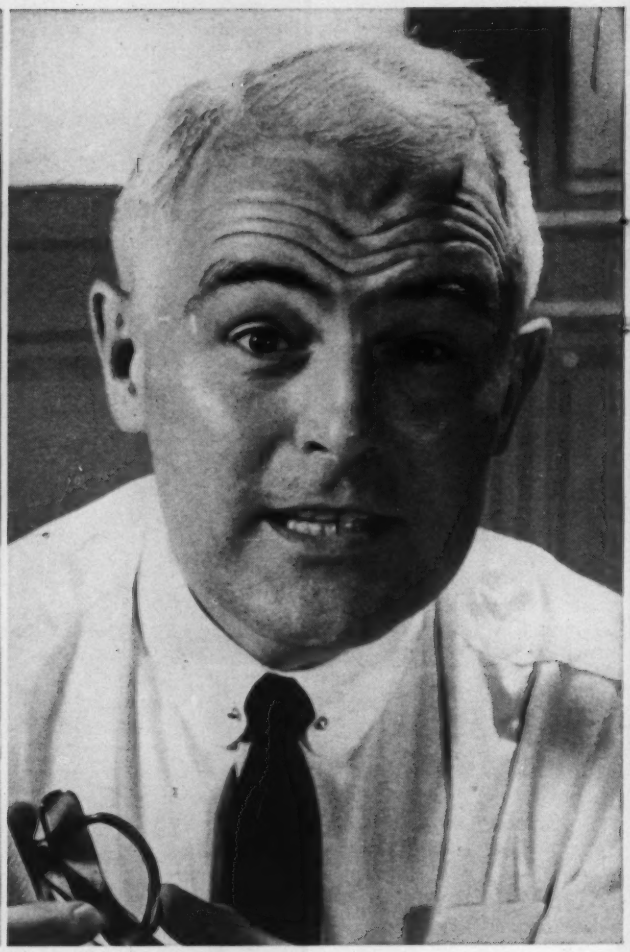
A POINT TO PONDER...*when you need gear drives or shaft couplings of "FALK OR EQUAL" quality, where but from Falk can you get the "OR EQUAL"?*

GOODYEAR

Hose? Goodyear





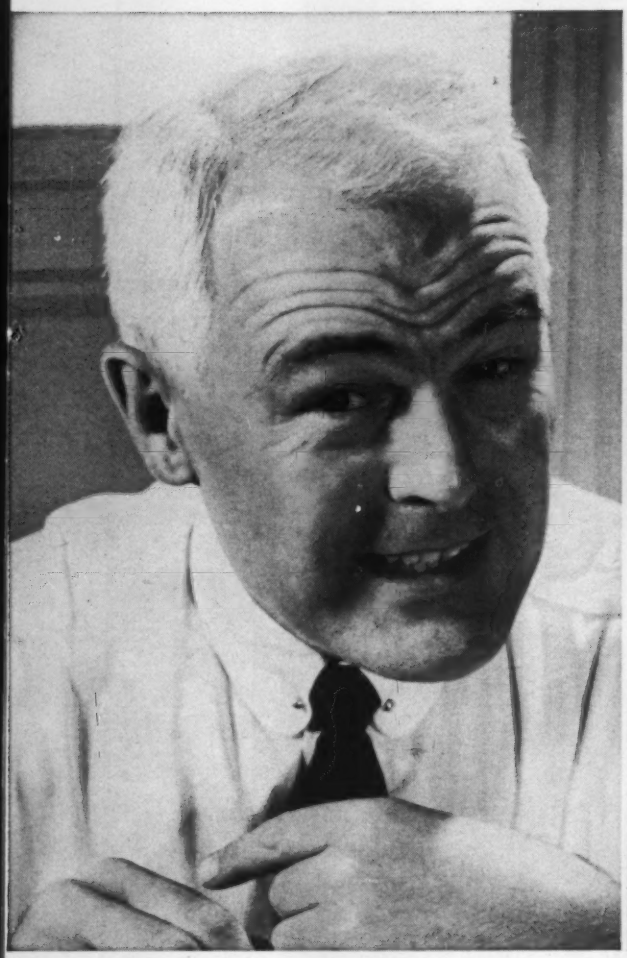
THE KIND I NEED?
(No matter how tough or unusual your application or what type hose it calls for—*Goodyear has the answer!)*

WHEN I NEED IT?
(When you need hose in a hurry—locally available right from distributor stocks—*Goodyear has the answer!)*

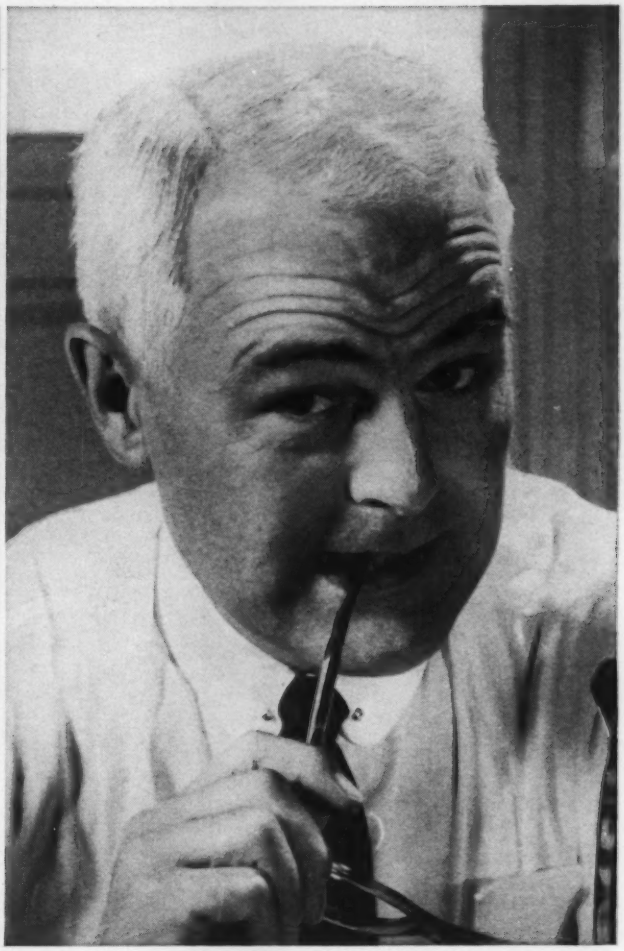
FOR THE RIGHT HOSE... AT THE RIGHT PLACE... CALL YOUR GOODYEAR DISTRIBUTOR... first in

Lots of good things come from GOOD

Has All the Right Answers!



TOUGH AS I NEED IT?
(For the extra ruggedness, extra dependability and extra safety of real quality hose—*Goodyear has the answer!)*



SPECIAL HELP WHEN I NEED IT?
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AT THE RIGHT TIME... AT THE RIGHT PRICE...
service with all industrial rubber products

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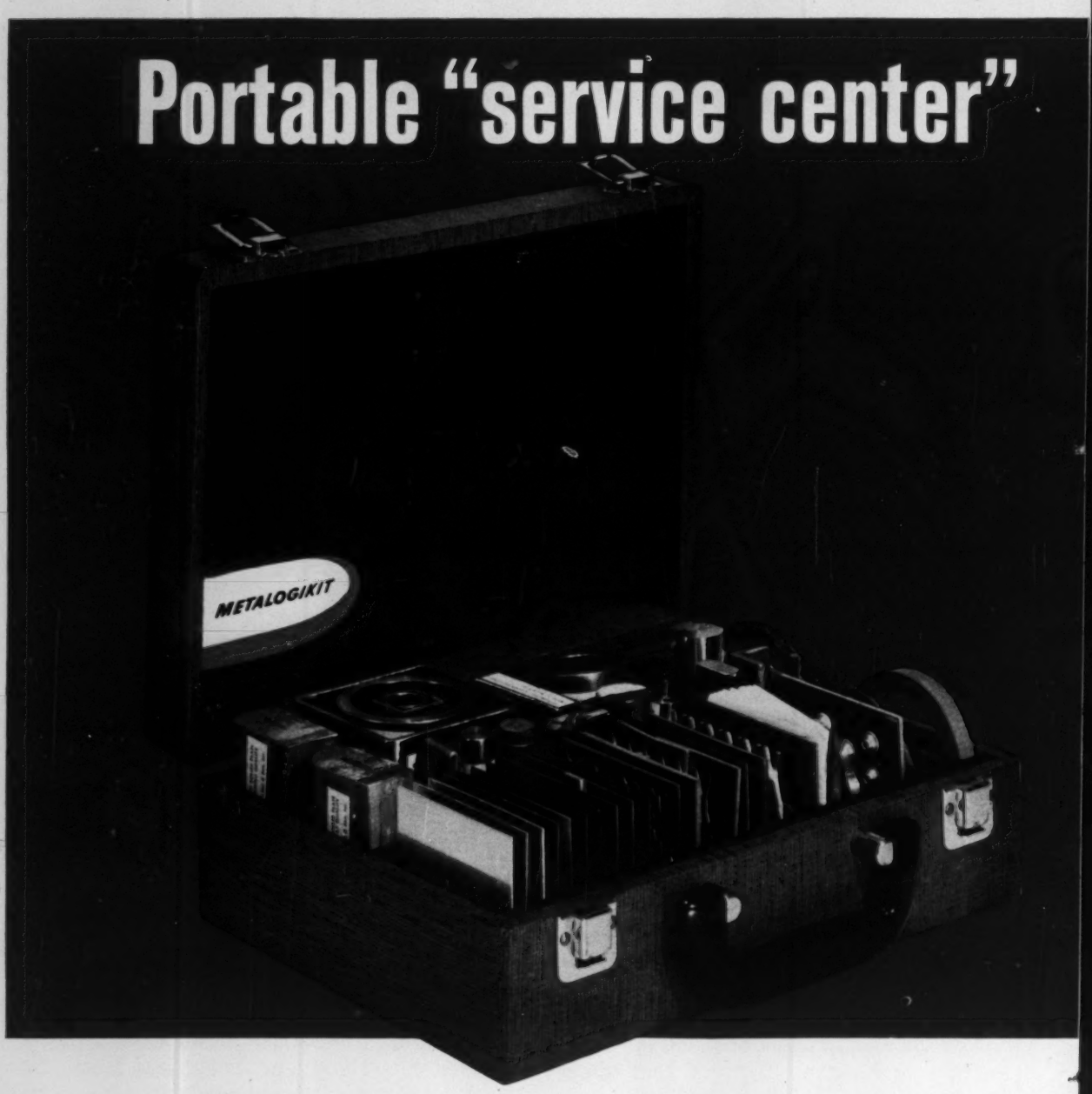
GOODYEAR INDUSTRIAL PRODUCTS

Portable "service center"



Hundreds of companies have saved money, improved products and cut production waste as the result of opportunities presented by the Ryerson "Metalogikit."

How? This unique kit is a veritable portable service center...lets you explore many alternatives to material you now use. For example, you can compare several different cutting methods on the same piece of steel to see which is best for your application.

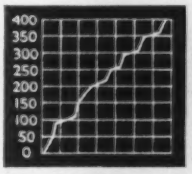
Following are a few random examples showing how Ryerson specialists, using the Metalogikit, have helped customers with a variety of problems—many similar to those you may face every day.

If you would like to put the Ryerson Metalogikit to work for you, call your Ryerson representative for a demonstration—for unbiased recommendations on steel, aluminum, plastics and metalworking machinery.

sparks new ideas and savings

KIT SPOTS SAVINGS

Scratches and grooves normal to cold drawn, seamless tubing caused high manufacturing costs for a company making small, light-wall hydraulic cylinders. The small I.D. had to be honed to eliminate these faults—often too much metal was removed for proper piston fit. A Ryerson specialist suggested a switch to *welded tubing*. Using a sample from his Metalogikit, he pointed out the better finish that eliminates expensive honing. The switch was made with these results: higher production, low reject rate, improved product—plus lower purchase price per foot of tubing.



METALOGIKIT TURNS UP 400% PROFIT

Bidding on a routine job was delayed for one steel fabricator because of an unusual material requirement in the specs—calling for an insulating block of phenolic laminate. For help, the company turned to its Ryerson representative, who showed a sample of Ryertex® sheet stock from his Metalogikit. In addition to having the material available from stock, he was able to show how easily it could be fabricated. This Ryerson know-how, demonstrated by the Metalogikit, enabled the customer to enter his bid on time. He got the job, and made a 400% profit.

KIT SUGGESTS PROFITABLE SPEC CHANGE

Fractures and rejects were extremely high for a manufacturer cold forming two severe bends in flat, hot rolled bars. A Ryerson specialist examined the ⅜″ x 2″ bar stock and compared it with a sample of M-1020 flattened round bar from his Metalogikit. He explained how controlled carbon of Ryerson M-1020 bar would produce great cost-saving advantages in this operation over hot rolled, mild steel. After specs were changed to this Ryerson-supplied bar, fractures and rejects were substantially reduced—resulting in new profitability.

STAINLESS FROM KIT LEADS TO SAVINGS

This company had an emergency requirement for stainless sheets. Application had always called for Type 304, 16 ga. x 66″ x 81″, *polished on one side*. Their Ryerson specialist questioned the need for polishing. From his Metalogikit, he showed them a sample of 304 with a 2B finish. The company readily agreed it was exactly the finish needed *without polishing*—saving delivery time and material cost. The Ryerson man further suggested 16 ga. x 72″ x 144″, using the cut-off pieces for another job—reducing scrap waste on *both* requirements. Order was placed and delivered in plenty of time. Over-all result: a substantial saving.

METALOGICS
RYERSON PLUS VALUES

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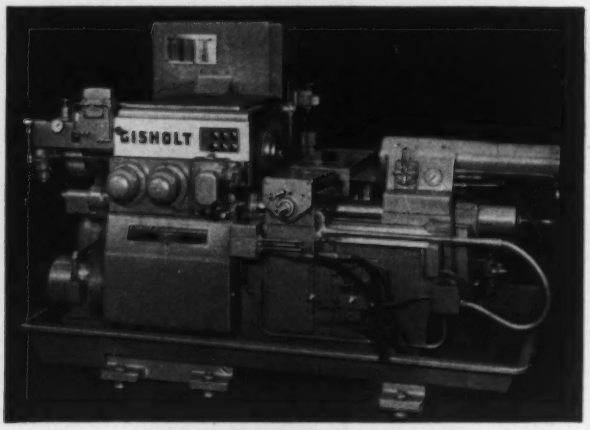
Versatility
Capacity
Quick Setup?



Gisholt No. 12 Automatic Chucking Lathe

You don't have to sacrifice one advantage for another because here is an ideal combination of all in the industry's most modern high-production automatic chucking lathe.

This Gisholt No. 12 is quickly set up to save you time and money on continuous, high-speed production or a wide variety of parts in small lots. It can take practically any part up to 16½" in diameter.

COST-CUTTING VERSATILITY. With 420 spindle speeds ranging from 40 to 2600 r.p.m. and an infinite selection of feeds, it gives you top efficiency in all phases of every job—cutting costs all the way.

INCREASES OPERATOR PRODUCTIVITY. Each machining step is handled in rapid automatic sequence—freeing your operator to handle additional machines.

GREATER POWER, GREATER ACCURACY. Constant h.p. motor (up to 40 h.p.) on the No. 12 takes full advantage of today's most advanced cutting tools and tooling techniques. Greater weight and rigidity allow heaviest cuts at punishing speeds without vibration.

COMPLETE RANGE OF ACCESSORIES. Front, rear, auxiliary and overhead slides can be used; angular cuts are easily made; JETracers can be used with greatest efficiency. Automation can be incorporated—from simple loading and unloading to gaging and sorting of finished pieces.

Your Gisholt Representative will gladly show you how the No. 12 Automatic Chucking Lathe will pay for itself in your plant. Call him, or write for Bulletin 1213.

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STEEL
The Metalworking Weekly

Metalworking Week®

January 2, 1961

Our Affluent Economy

	1951	1961	change
Metalworking sales	$100 billion	$146 billion	+46%
Gross national product	$329 billion	$506 billion	+54%
Plant & equipment expenditures	$25.6 billion	$33.6 billion	+32%
Steel production (ingot tons)	105 million	99 million	−6%
Passenger car output (units)	5.6 million	5.8 million	+4%
Primary aluminum production (tons)	836,881	1.92 million	+129%
Refined copper production (tons)	1.2 million	1.6 million	+33%
Refined lead production* (tons)	486,874	1.05 million	+116%
Civilian labor force[1]	62.9 million	72.2 million	+15%
Total employment[1]	61 million	67.5 million	+11%
Manufacturing employment[1]	15.9 million	16.2 million	+2%
Metalworking employment[1]	6.7 million	7.8 million	+16%
Personal income	$257 billion	$419 billion	+63%
Consumer expenditures	$210 billion	$340 billion	+62%
For durable goods	$29.5 billion	$44 billion	+49%
For nondurables	$110 billion	$159 billion	+45%

*Primary and secondary. 1. Average.

Downturn to Be Moderate

Look for this recession to have only about half as much sting as the last two. While a statistician can make a good case for either a worse recession than we experienced in 1958 or a healthier year than we had in 1959, most practical economists think the odds favor a moderate decline in the first half, with an upturn starting about mid-year and building rapidly toward boom proportions by 1962. The kicker: Durable goods industries will be hardest hit by the downturn.

GNP: A Dollar Record

Look for gross national product to reach a record $506 billion in 1961. It'll come about due to a smashing second half. The GNP annual rate, by quarters, will probably run about like this: $496 billion in the first quarter, $502 billion in the second, $510 billion in the third, and $517 billion in the fourth. In physical volume, national output will about equal that of '60.

Industrial Production: Down, Then Up

Expect the Federal Reserve Board's index of industrial production (1957 = 100) to average 105 this year—vs. 108 last year. By quarters, it's likely to shape up this way: 102 in the first, 103 in the second, 106 in the third, and 109 in the fourth.

Government Spending Will Increase

The federal government is already showing signs of hiking expenditures. State and local governments are riding a record spending wave. The result

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is a probable 6 per cent increase in government purchases this year vs. last year's. Outlays will be higher for defense, highways, and public works projects.

Consumers Hold the Key; Will They Turn It?

The crystal ball says personal income this year will rise 3 or 4 per cent above last year's record mark. It's likely to approximate $420 billion. But the key question is: Will the consumer loosen his pursestrings? Consumer confidence has remained remarkably high so far—despite soaring unemployment figures. If that confidence holds, spending for durable goods could exceed expectations. Look for consumers to shell out around $44 billion for durable items this year.

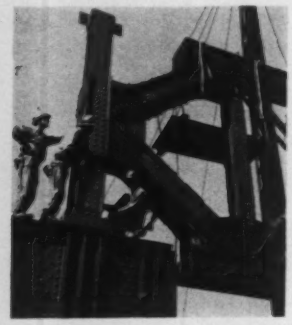
Inventories: Liquidation Will Continue

Look for the rate of inventory liquidation to slow down after the first quarter, but don't expect substantial accumulation before the fourth quarter. Hand-to-mouth buying will likely prevail throughout the year.

Capital Spending: Strong though Slower

Don't be surprised if plant and equipment expenditures remain at a high level in 1961. Best estimates place outlays at $33.5 billion to $34 billion—down 5 to 6 per cent from the 1960 mark.

Construction: Another Record Coming



Watch for new construction to reach $57 billion this year—up more than 3 per cent from 1960's $55 billion. The gain in dollar volume will come largely in residential and public building. Activity in commercial areas will be about the same this year as last. Industrial construction will slump. The seasonally adjusted annual rate of private nonfarm housing starts is likely to rise to 1.35 million units by the end of this year.

Exports: A Fight to Stay Even

U. S. exports scored a dramatic, 20 per cent increase in 1960. In many cases, the trend will continue in 1961. But exporters will have a tough time equaling last year's shipments of $19.5 billion. Reason: The '60 total included large shipments of cotton and commercial aircraft, which won't be repeated this year. Exports of consumer durable goods are likely to increase in 1961, as demand in Europe outruns supply. Exports of steel mill products can be expected to hold at the '60 level.

Motordom: Consumers Will Spend Less for Wheels

You can get about any kind of prediction you want for 1961 motor vehicle production if you talk to enough people. Forecasts of passenger car production range from 5.5 million to 6.5 million units. STEEL polled a group of economists and came up with an average prediction of 5.8 million units. The forecasters expect truck production to total around 1 million units.

Steel: A Midyear Upturn

Look for steel ingot production to total 99 million tons this year. (Industry estimates range from 95 million to 106 million.) Steel company executives, like Harleston R. Wood (photo), president, Alan Wood Steel Co., predict that the industry will reach an operating rate of 75 to 80 per cent of capacity before midyear. You can probably expect output by quarters to stack up this way: 20 million tons in the first quarter, 23 million in the second, 27 million in the third, and 29 million in the fourth. Industry analysts say that steel inventories have about reached bottom in most consumer goods industries but that more liquidation is coming in machinery and construction.

Farm Equipment: Purchases Up

Federal aid and crop situations have pushed up farm incomes 5 to 10 per cent. That will mean a higher level of equipment purchases in the next 12 months than in the last. Machinery makers can expect at least a 5 per cent improvement.

Appliances: Steady but Unspectacular

The appliance market will be bolstered largely by the expected high rate of new housing starts. Replacement sales will probably be about as high this year as in the last few years. Result: Good but unspectacular business in 1961 that could equal or slightly exceed 1960 levels. Maytag's president, C. M. Umbreit (photo) and other appliance industry executives say the second half will be better than the first. Forecasts range from "down 4 per cent" to "up 3 to 5 per cent" from the 1960 level.

Prices: Stability Will Continue

Expect price stability to prevail for at least the next six to nine months. Virtually no change is foreseen for the wholesale price index during the year ahead—although some forecasters think the price level will decline during the first half, then gradually rise during the second half. The consumer price index is likely to climb around 1 per cent. As Jules Backman, research professor of economics, New York University, put it: "The general dragging tendencies in the economy, the large surpluses of key farm products, and the available excess capacity should provide an effective barrier against a signifi-

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The Metalworking Weekly

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cant price inflation." You can expect price fighting to continue in most metalworking industries during the next six to nine months.

Machinery: Biggest Question Mark in Metalworking

If this segment turns up, all industry would probably have an excellent year in 1961, but the prospects now are mediocre. Look for producers of nonelectrical machinery to sell $29 billion worth of their products this year—down more than 5 per cent from 1960. Makers of electrical machinery and equipment can expect sales of about $25 billion, the same as last year.

Containers: They'll Resume Annual Growth Rate

In 1960, for about the first time since the end of World War II, canmakers failed to achieve their annual 3 to 4 per cent growth rate. Crop failures and other factors forced a poor year. But the growth pattern should be resumed in 1961. Sales for barrel and drum producers, however, may decline moderately.

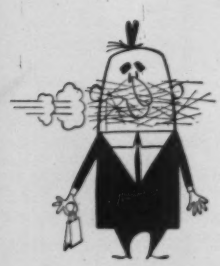
Oil and Gas Hardware: Up Slightly

Although oil and gas drillings will dip to 43,000 in '61, the industry should be a better customer for metalworking than it was last year. Reason: It has been working off heavy inventories, especially of steel. Around 4.4 million tons of steel should be shipped to it in the coming 12 months, slightly more than last year's total. Of that tonnage, 1.4 million will go for drilling and 3 million for pipelines.

The High Cost of Wasted Time

What does it cost you per year if each of your employees wastes only 5 minutes a day? If the average hourly wage is $2.50 and you have 500 employees, it costs you $53,130. If the average wage is $2.75 and you have 100 employees, it costs you $11,688. A new moving chart (free copies are available) developed by Kelly-Read & Co., Rochester 5, N. Y., shows graphically what 5 minutes waste per day per employee costs your company.

Straws in the Wind



This shapes up as another year in which the economy will continue to build a bridge between the boom of 1940-57 and the decade of prosperity that will begin when the tidal wave of postwar babies starts entering the labor force and the market place—affecting demand for consumer and industrial goods. The current downturn has tended to color some long range appraisals. It's well to remember that the basic premises from which a golden decade was projected are still valid. A gross national product of $750 billion by 1970 is still likely.

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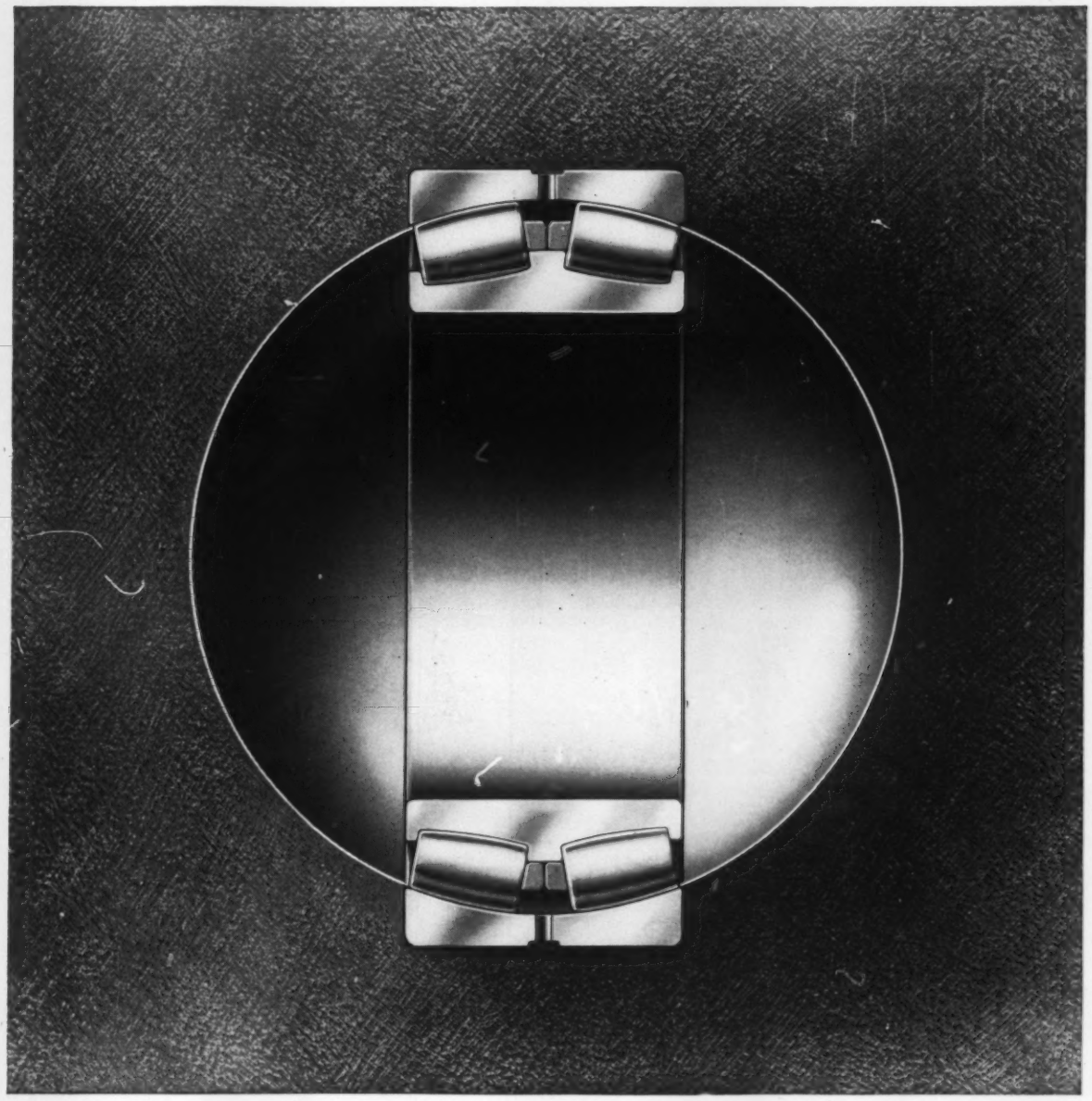

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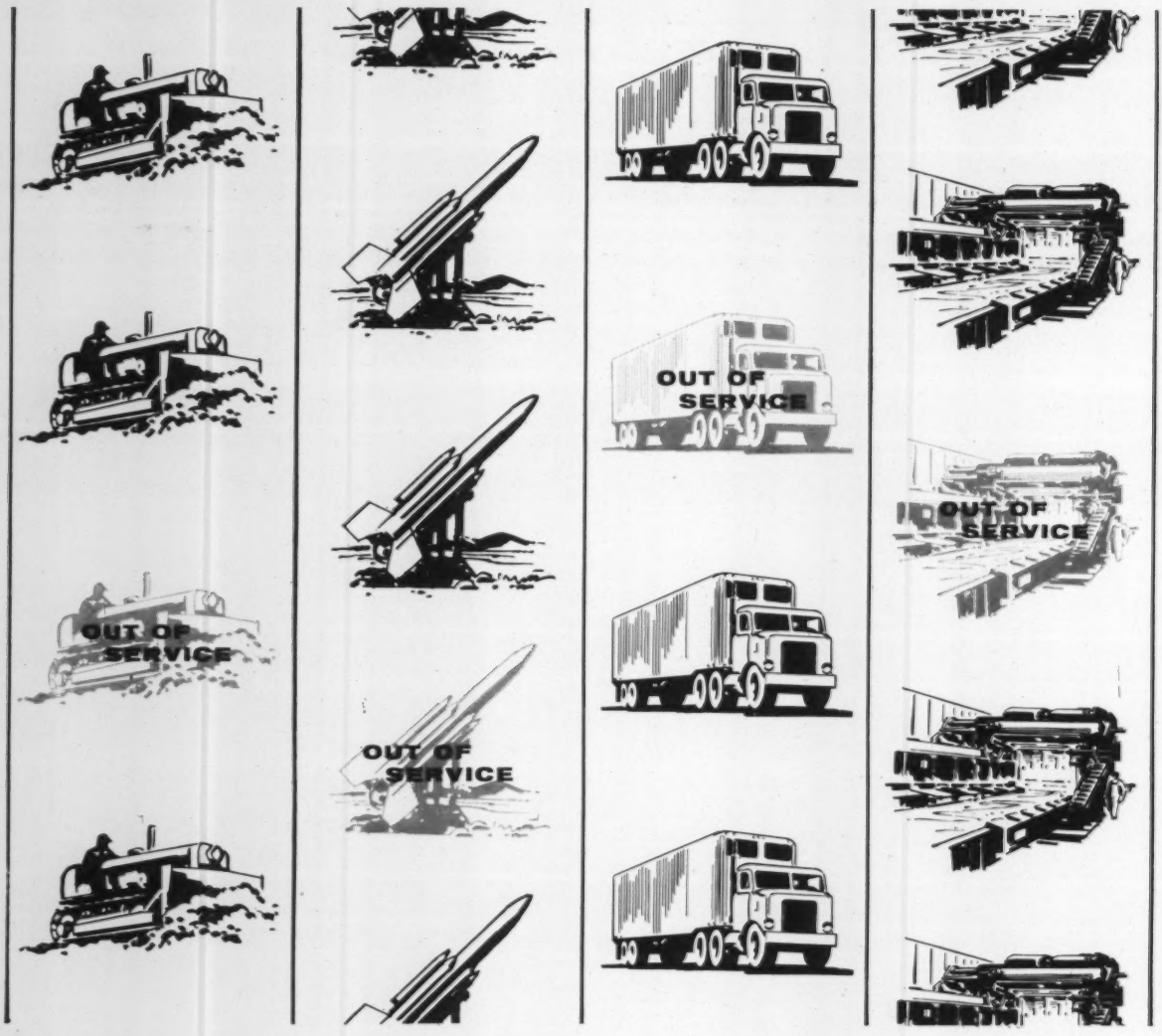

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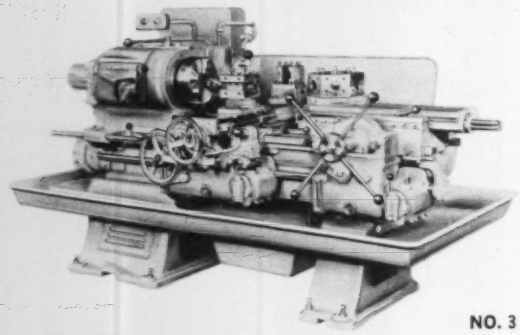

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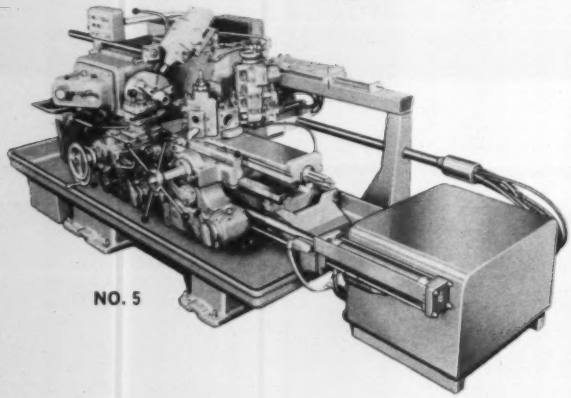

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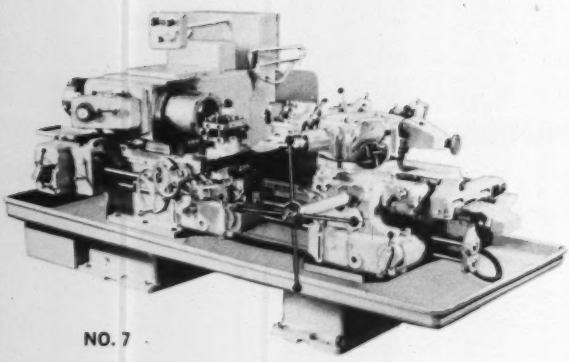

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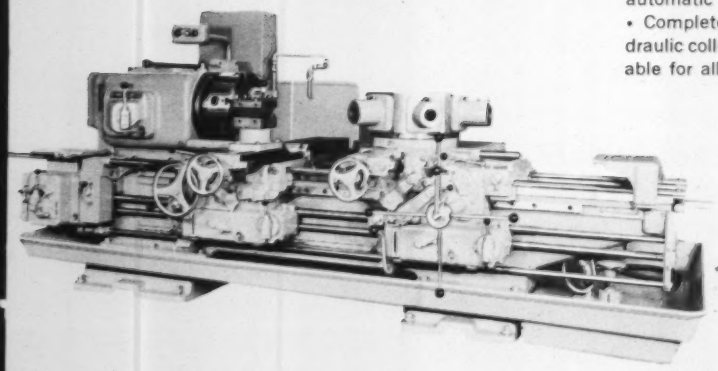

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Automatic lubrication system with forced feed to all slide bearings.

Complete coolant system — automatic internal delivery to each hexagon turret position.

Adjustable graduated handwheel dials and chrome-plated handwheels, dials and levers.

Rugged hydraulic collet chuck and bar feed mechanisms are provided for Jones & Lamson Universal Turret Lathes.

The New Multi-Speed Hydraulic Headstock for #4, #5 Ram and #7A Series Saddle Type Turret Lathes

Automatic Headstock uses hydraulically operated clutches for changing spindle speeds • Single knob speed selector for pre-selection of 12* spindle speeds 20-1000 RPM, 30 to 1500 RPM, 40-2000 RPM • 40 HP constant speed motor — ample HP at all speeds.

Heavy-duty aprons can accommodate full length lead screw threading attachments and 2 Dimensional carriage tracers • Diagonal cross-ribbed bed and 41" leg depth provide extreme rigidity for heavy cuts • Built-in hydraulic supply system.

*24 speed headstock available.

Powerful Saddle Type Machines with either Fixed Center or Cross-Sliding Hexagon Turret

Reverse feed control for carriage and saddle* • Independent centrifugal coolant pump • Improved adjustable graduated handwheel dials • Large coolant sump located at turret end of pan • Saddle stop bars protected by steel guard • Single lever spindle speed selector • Single lever apron feed selectors • Hardened and ground steel ways — with full length stationary way guards • Heavy duty spindle mounting with rugged pre-loaded bearings • Bridge-type carriage for multiple tooling at front and rear of cross slide • Heat-treated precision finished alloy steel gears • Positive accurate automatic stops for both the carriage and the saddle • Completely automatic lubrication throughout • Hydraulic collet chuck and bar feed mechanisms are available for all J & L Universal Saddle type turret lathes, except Model 10-6½, for which only a bar feed mechanism is available.

*Applies to only Type B

RAM TYPE	No. 3		No. 4		No. 5		No. 5-3		No. 5-4½	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max	Min.	Max.
Bar Capacity*										
Round	3/16"	1½"	3/16"	2"	3/16"	2½"	½"	3"	1"	4½"
Hexagon	3/16"	1¼"	3/16"	1¾"	3/16"	2⅛"	½"	2⅝"	1"	3⅞"
Square	3/8"	1"	3/8"	1⅜"	3/8"	1¾"	½"	2⅛"	1"	3⅛"
Standard Ram Travel		10"		10"		14"		14"		14"
	Dia.		Dia.		Dia.		Dia.		Dia.	
Scroll Chuck Capacity	10"		10"		12"		12"		12"	
Swing										
Over Bed Ways	21¼"		21¼"		21¼"		21¼"		21¼"	
Over Carriage Guides	18½"		18½"		18½"		18½"		18½"	
Over Carriage Cross Slide	11"		11"		13"		13"		13"	

*Nos. 5-3 and 5-4½ use 2½" bar capacity turret tools.

Hydraulic Tracing

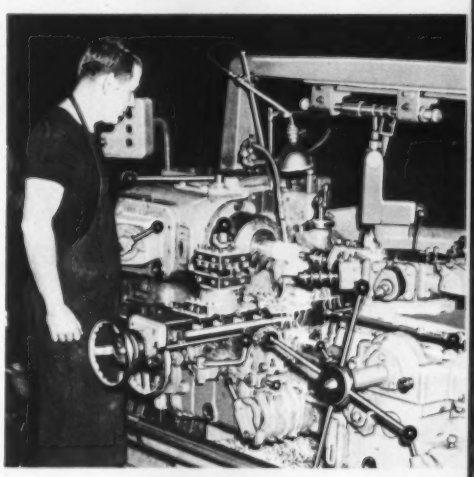
Single dimension carriage tracing attachments are available for both J & L saddle and ram type universal turret lathes.

Multiple diameters may be faced, turned, tapered or profiled; while other operations, such as threading, boring, reaming, tapping, and roughing cuts to expedite tracing operations, may be performed from the other tool positions available on the turret lathe.

Two-way tracing from the cross slide or the cross-sliding hexagon turret, or both, is also available.

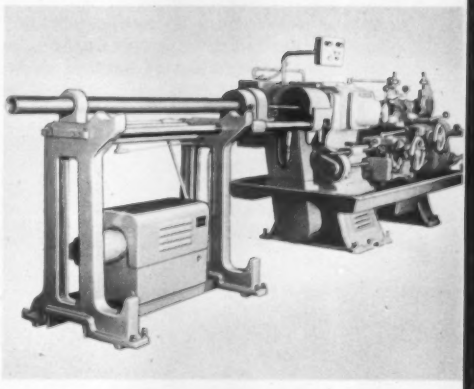
The Two-Dimensional Tracer* for the cross-slide carriage offers four 180° tracing cycles (see No. 5 turret lathe on facing page). Feed may be toward or away from the headstock or the spindle center line.

The tracing attachment is disengaged by selector switch for standard turret lathe operation.



Hydraulic Collet Chuck and Bar Feed

This unit completely eliminates the problem of operator fatigue caused by continuous manual operation of the bar feed and collet chuck mechanism at high production rates. Now, with the fingertip control of bar feed and chuck, you can conserve the operator's energy, boost his morale, and increase his production.



Auto-Threader

Provides a fully automatic thread chasing cycle for single-point tool. It combines the advantages of turret lathe rigidity: full use of normal turret lathe operations; and automatic threading, all in the same chucking.

Precision lead control is obtained by positive follower nut engagement on a hardened and ground leader. A combination taper and straight thread can be chased, internal as well as external.

"A" MACHINES ARE FIXED CENTER HEXAGON TURRET "B" MACHINES HAVE CROSS-SLIDING HEXAGON TURRET

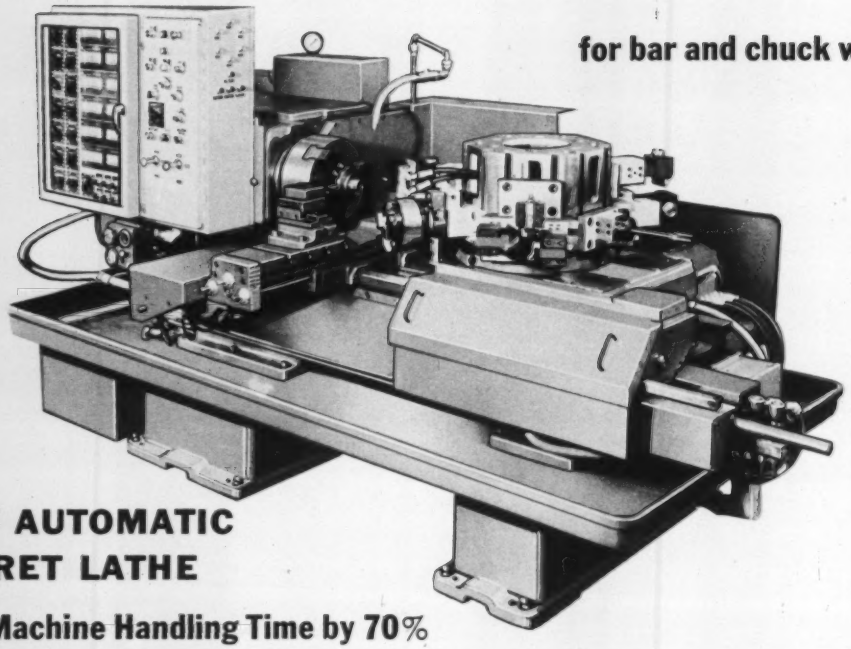
SADDLE TYPE	No. 7-2½		No. 7-3		No. 7-3½		No. 7-4½		No. 9-3½		No. 9-4½		No. 10	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Bar Capacity														
Round	3/16"	2½"	½"	3"	¾"	3½"	1"	4½"	¾"	3½"	1""	4½"	2"	6½"
Hexagon	3/16"	2⅛"	½"	2⅝"	¾"	3"	1"	3⅜"	¾"	3"	1"	3⅜"	2"	5½"
Square	3/16"	1⅝"	½"	2⅛"	¾"	2 7/16"	1"	3⅛"	¾"	2 7/16"	1"	3⅛	2"	4½"
Machine	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Maximum Turning Length**	37	34	37	34	35	32	35	32	40	37	40	37	(no collet chuck available)	
	Dia.		Dia.		Dia.		Dia.		Dia.		Dia.		Dia.	
Scroll Chuck Capacity	12"		12"		12" or 15"		12" or 15"		15"		15"		18" or 21"	
Swing														
Over Bed Ways	21¼"		21¼"		21¼"		21¼"		26"		26"		35"	
Over Way Covers	19"		19"		19"		19"		23½"		23½"		32½"	
Over Carriage Guides	18"		18"		18"		18"		23½"		23½"		32½"	
Over Carriage Cross Slide	13"		13"		13"		13"		16"		16"		22½"	

*Nos. 7A and B-2½ and 7A and B-3 use 2½" bar capacity turret tools. Nos. 7A and B-3½ and 7A and B-4½ use 3½" bar capacity turret tools.

**With standard collet chuck and standard roller backrest turner. Turret indexed and locked.

If the J & L general line insert is missing, write JONES & LAMSON, 517 Clinton St., Springfield, Vermont, for your copy.

for bar and chuck work



NEW AUTOMATIC TURRET LATHE

Cuts Machine Handling Time by 70%

This new machine packages the versatility of turret lathe tooling with completely automatic operation. All machine functions and sequences are pre-selected and programmed by the operator or set-up man from a staging panel during initial set-up.

Automatic operation of a 12- or 24-speed hydraulic clutch headstock is combined with a 24" saddle motion for ample machine capacities and rigid tool support.

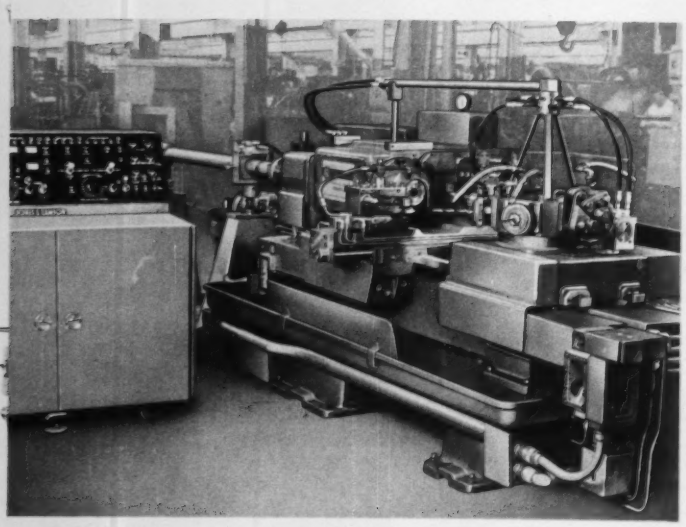
Automatic machine characteristics include: fast motion, variable feed selection, spindle speed selection, turret indexing, coolant on and off, bar feed, and cycle stop.

The cross slide has a 14½" stroke and drive similar to that of the saddle. It has several automatic cycles as programmed from the staging panel.

Two speed ranges are available, 24 to 1000 and 29 to 1200 R.P.M., powered by a single speed drive motor (up to 40 H.P.).

Work swing over the ways is 21¼". There are fifteen cross feeds for the carriage and fifteen longitudinal feeds for the hexagon turret. Rapid traverse for the carriage is 250" per min., and for the hexagon turret is 500" per min.

NUMERICAL TAPE CONTROLLED TURRET LATHE



This Tape Controlled Turret Lathe combines 1" 8-Channel Tape Programs with preset tooling to drastically slash set-up time. 14 tooling positions are available, and all 14 tools can be changed in 10-15 minutes. Machine motions are actuated through a time-proven closed loop, hydraulic servo system, and are controlled through reliable circuitry, using mercury wetted relays and plug-in "remove-and-replace" units.

Numerical Controlled Turret Lathe operation greatly increases the time the machine is actually producing, also allows for profitable production lots as small as one piece.

Machine Capacities are comparable to the Standard Jones & Lamson #5 Turret Lathe.

PRECISION BORING MACHINE

Here is a new, low-cost machine for precision turning, boring and facing. Single or Multiple Spindle • Ideal for both long and short runs; versatile; easy to set up.

Features include:

Specially designed spindle for ultimate in finish, roundness, and size • Push-button cycling (manual or automatic) • 4-speed spindle drive • Air-actuated table with hydraulic check unit • Single control for stop, feed and rapid traverse • Many variations, including constant surface speed on facing are applicable to this extremely accurate and versatile machine.

Multiple spindle arrangement available.

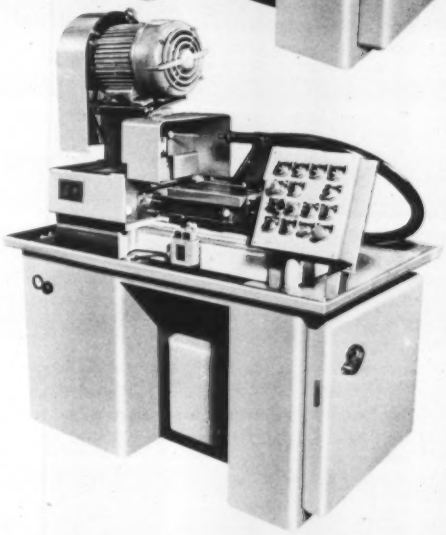
Swing is 10″ dia. max. Stroke is 7⅝″ max. Bore dia. .090″ min. to 3″ max.

PRECISION GUN DRILLING MACHINE

Accurate Gun Drilling (deep hole drilling) is accomplished rapidly with this new push-button controlled machine.

Specific features are these:

Specifically designed spindle with variable speeds up to 15,000 R.P.M. • Air actuated table with hydraulic check • Tell-Tale filtering with in-built features holding filtering to 5-10 microns • Rotating seal and power unit guarantees 12 gallons of coolant per minute at 2,000 lbs P.S.I. • Multiple Spindle arrangement available • High penetration rates (12″ per minute, not unusual) • Handles work from ½″ dia. down to the smallest gun drill available • Hole straightness held to .0005″ over 6″ length Dia. held to .0002″ • Spindle speeds to 15,000 R.P.M. Max. length of hole 6″. Max. dia. ½″, min., .074. Max. stroke is 7¾″.



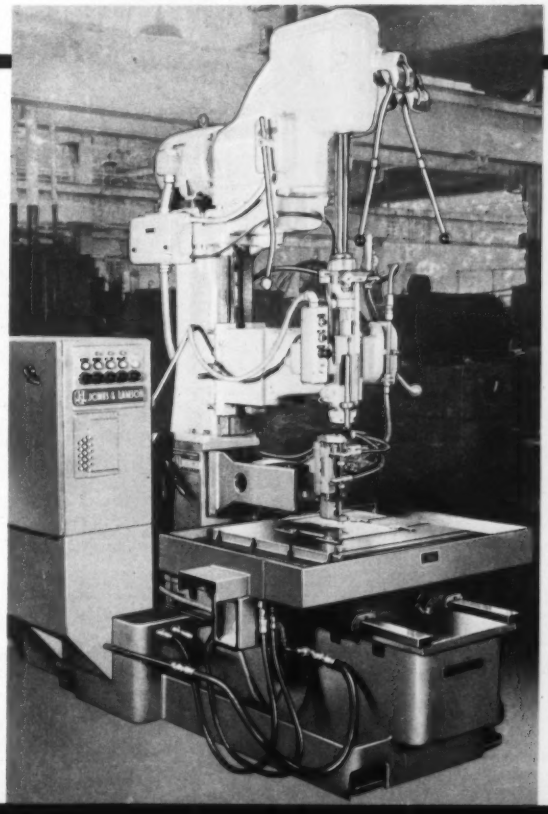
NUMERICAL TAPE CONTROLLED POSITIONING TABLE

This automatic positioning table, shown working in conjunction with a drill press, illustrates J & L's application of "Automation" techniques to small-lot production. The locations for work on the piece are programmed by means of a 1″ 8-channel tape. This not only assures repetitive accuracy, it also cuts set-up and change-over time and greatly increases small-lot flexibility. The unit is equally adaptable to long-run, high-production jobs. Cycle times are fast and accurate. Cost of storing, handling and maintaining jigs is virtually eliminated.

Table Travel 12″ x 20″ or 20″ x 20″.

Hole To Hole Speed 190″ per min.

Accuracy of Positioning ±.001″



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AUTOMATIC TRACING AND TURNING LATHES

Automatic Work Handling, Including

THE NEW FAMILY OF MODEL 30 AUTOMATIC TRACING AND TURNING LATHES

Model 30 60° Tracing Lathe

SPECIFICATIONS	MODEL 30-60°	MODEL 30-180°	MODEL 30 MULTI-SLIDE
Swing over Rails.....	23" Dia.	23" Dia.	23" Dia.
Swing over Tracer or Vertical Slide.....	13½" Dia.	13½" Dia.	13" Dia.
Length Between Centers.....	24", 48", 72"	48", 72"	24", 48", 72"

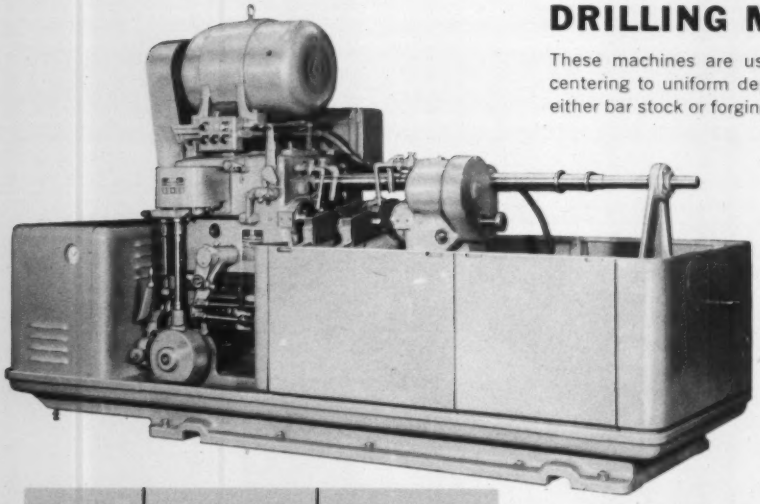
These machines all feature a wide range of spindle speeds (up to 32), with automatic speed and feed change during a cut. A variety of components may be selected for addition to the base machine to meet specific requirements. For instance, a rugged 6" hydraulic ram tailstock is mounted on the lower bed for between-centers work. Multiple tooling may be applied to a rear forming slide, or a rear facing, forming and turning slide, also mounted on the lower bed. Two bevel facing, or necking slides (one light-duty, one heavy-duty) are available for mounting on the front side of the lower bed. The upper bed may carry a multiple tooled turning slide (Model 30-Multi-Slide), a 60° tracing slide (Model 30-60° Tracer), or a 180° (two-dimensional) Tracing Slide (Model 30-180° Tracer). More than one slide may be used depending on bed length. The two-dimensional slide is hydraulically controlled and may be multiple tooled for tracing operations for any one of eight different tool travel cycles, all of which control tool motions through a full 180° of travel.

Two different headstock transmissions are available (16 speed or 32 speed) as well as two different spindle noses (6" A-1 or 8" A-1).

Controls are unique, reliable and extremely accessible. On reorder, for instance, set-up is accomplished in a matter of minutes through the setting of graduated dog rings on the conveniently located control drum.

MILLING AND CENTER DRILLING MACHINES

These machines are used for milling to length and centering to uniform depth various shafts made from either bar stock or forgings, in a single automatic cycle.



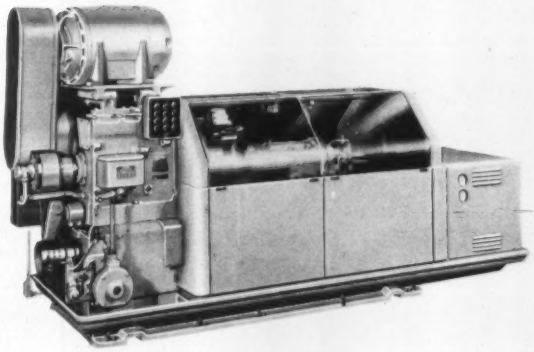
	Work Diameter	Work Length
Capacity	¾" to 3½"	45", 63", 81"

Camshafts, small crankshafts, bevel pinions and main drive gears are typical examples. The starting lever and work-holding fixtures are hydraulically operated.

FAY SINGLE SPINDLE AUTOMATIC LATHES

Inter-Machine Transfers, are Applicable

	8"	12"	16"	20"
Capacity between Centers	21", 33", 45"	21", 33", 45" 63", 81", 99"	21", 33", 51" 69" and 87"	25", 37", 55" 73" and 91"
Radial Dimension: Center of spindle to top of carriage	4 9/16"	5 1/2"	6 5/8"	8 3/8"
Radial Dimension: Center of spindle to top of center bar	5 1/2"	6 31/32"	8 3/4"	10 29/32"



16" Fay with Automatic Sequential Control

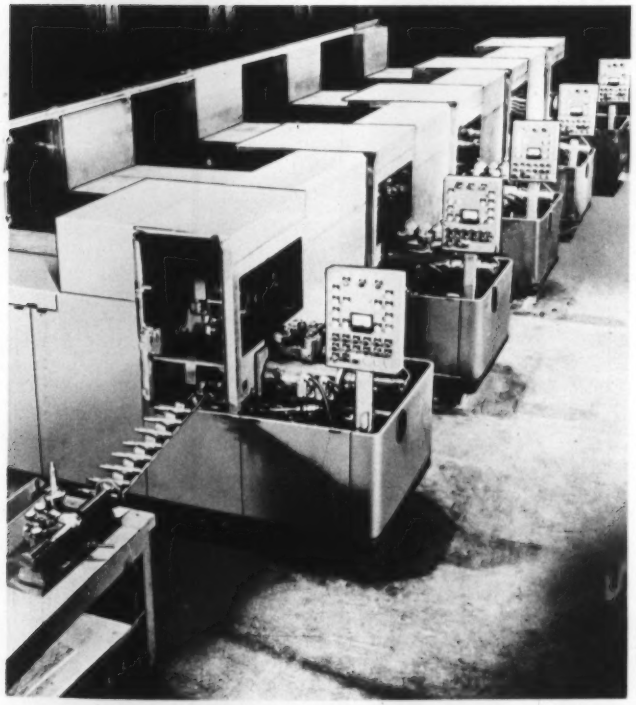
FAY single spindle automatic lathes are built in 8", 12", 16" and 20" sizes, and in a wide variety of bed lengths. All are powered for rugged cuts at high speeds, and are capable of high repetitive accuracy.

The FAY Automatic Lathe is a universal machine that is completely automatic in its cycle. The operator simply places the work in the machine, and presses the starting button. The machine goes through a full sequence of operations, stopping automatically when the cycle is completed.

The FAY has high production capacity, is simple to operate, is extremely accurate, and ruggedly built. It is designed to make best possible use of carbide cutting tools. It has maximum rigidity, to transmit in excess of 75 H.P. at high surface speeds and substantial feeds.

The FAY is adapted to the machining of forgings, castings or bars that can be held on centers, machining of chuck work, or work supported on fixtures, and to the turning of work mounted on arbors.

Easy change-over from one job to another, plus positive camming, makes the FAY a highly profitable investment, not only on mass production work, but also for small job shops, for short runs on a variety of work.



AUTOMATIC WORK HANDLING

This is a typical example of one J & L approach to "automation". The production efficiency of this pinion gear blank production line is little short of spectacular.

In action, this sequential, automatic line eliminates the handling of tons of metal, and substantially increases the production of automotive pinion gear blanks. The machining of stock is precise and rapid, and the transfer of work pieces is done automatically and sequentially. Such control combinations are tailor-made for each application. The arrangement illustrated employs one milling and center-drilling machine and four Fay automatic lathes. In addition to completely automatic, sequential operation, each machine control can operate its own machine manually for tooling setup, etc.

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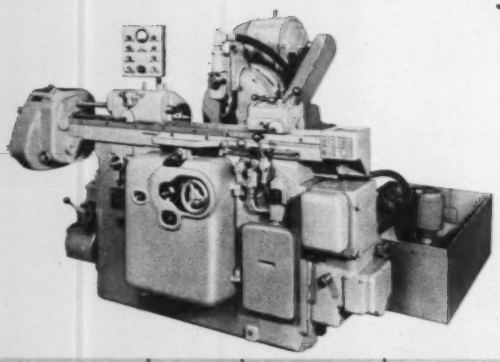
AUTOMATIC THREAD



Models TG-615, TG-636 and 12 x 45 Thread Grinders

The 6 x 15" Automatic Thread Grinder is used for high-production thread grinding with multi-rib wheels, on relatively small, light work.

The larger models are used on long- or short-run jobs on taps, studs, gages, hobs, worms, spindles and precision threaded parts. They are also used for various kinds of form grinding. Single-rib, three-rib or multi-rib wheels can be used. They are fully automatic in the work cycle. Automatic dressing of the wheel, automatic sizing and automatic compensation for the amount dressed off the wheel, are some of the features that make these machines the finest of their kind for high precision thread grinding.

These machines can be arranged for plunge grinding single or multiple grooves on contours. Multi-ribbed wheels, either diamond or crush dressed, are adaptable for all models.

	TG-615	TG-636		TG-1245	
	**	*	**	*	**
Max. Thread Dia.....	6"	6½"	6½"	12"	12"
Max. Thread Length....	2"	12"	2"	18"	2"
Max. Work Diameter...	7½"	7½"	7½"	21"	21"
Max. Work Length.....	30"	36"	31"	45"	40"
Max. distance from end of thread to headstock center....	14¾"	29"	19"	33"	28"

*Single Rib Wheel. **Full Multi-rib Wheel.

Models E-2 and E-3 Form Grinders

Completely Automatic Cycle — High speed approach, variable wheel feed, spark out and withdrawal are positively controlled through simple cam action.

Automatic Positive Size Control — Wheel slide held against positive stop with uniform hydraulic pressure.

Automatic Trueing Device With Controlled Dressing — Once per piece or once for predetermined number of pieces.

Crush, Wheel, Diamond Trueing, or PFC.

Automatic Handling or Manual Handling.

Completely Versatile — Chucking work, center work or shoe-type support.

MODEL	E-2	E-3
Max. Dia. of Work Ground.....	8"	8"
Max. Dia. of Swing.....	31"	31"
Work Spindle Speeds.....	50-1500	50-1500
Max. Swivel Angle of Platen.....	15°	15°
Max Width of Spaced Wheels....	5"	12"

Model F Thread Grinder

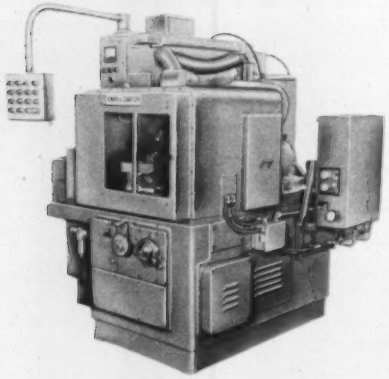
Designed for high-production thread grinding of taps or small threaded parts. May be equipped with automatic work handling and magazine feed. Has a wide range of work speeds for effective grinding on all tap sizes from 0 to ¾" diameter.

Individual lead screws for each pitch have one-third the pitch of the thread being ground, ensuring a long lead screw life. Simple cam action positively controls rapid wheel advance, depths of cut and rapid withdrawal.

Max. thread length 3"

Max. swing over table 10"

Work spindle speeds 30 to 360 RPM

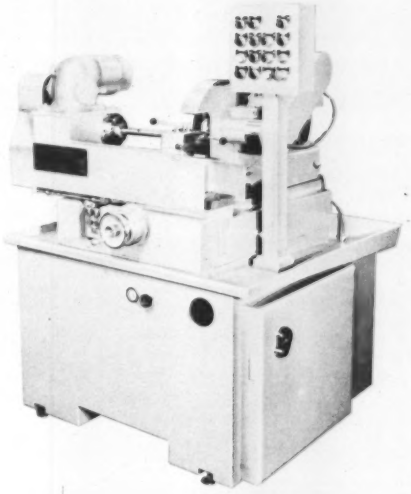


AND FORM GRINDERS

Model 410 Semi-Automatic Thread Grinder

This machine is designed for those who have need for a low-cost thread grinder to grind their own threads rather than subcontract them at relatively high prices.

It features extreme simplicity in operation and set-up. Work speeds are infinitely variable. Change gears make a full range of pitch diameters available for both right- and left-hand threads. The work-slide, wheel-slide and dresser-slide are all mounted on preloaded roller bearings for smooth and accurate traverse.



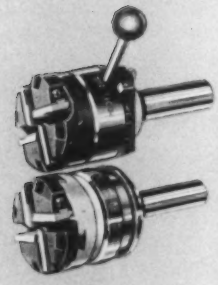
SPECIFICATIONS

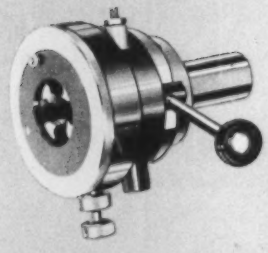
Max. thread dia. 4"	**Max. wheel speed 2000 RPM**
Max. thread length 10"	**Work spindle speeds 3 to 116 RPM**

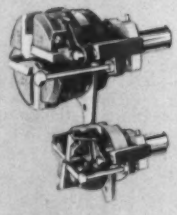
PFC* (perpetual form control) is the designation of a revolutionary new grinding method that utilizes cemented diamond particles as cutters for retaining wheel form. Thanks to PFC there is now no cycle time out for wheel dressing. Except for handling, floor-to-floor time is now all actual grinding time.

*Applicable to all J & L grinders except Model 410.

Class III Guaranteed Thread Tools







Revolving & Stationary TANGENT DIE HEADS

Automatic Opening . . . J & L Tangent Chaser Die Heads, with ground thread chasers produce Class III or better threads at speeds limited only by the material being threaded. Capacities are from No. 4 to 2". **Stationary & revolving types** available.

Automatic Opening RADIAL DIE HEADS

These Die Heads, with ground thread chasers, are especially adaptable to coarse pitches and multiple-start Acme. Over-all capacity from No. 8 to 4¼" either right- or left-hand.

Brown and Sharpe Type DIE HEADS

For B & S Automatics and small turret lathes.

No. 16-S is for use on B & S No. 00,000G,0 and 0G and small turret lathes. No. 18-S is for B & S No. 0,0G,2 and 2G and the No. 19-S, with wider range, for B & S No. 2 and 2G. These dies use ground thread tangent type chasers.

Revolving and Stationary COLLAPSIBLE TAPS

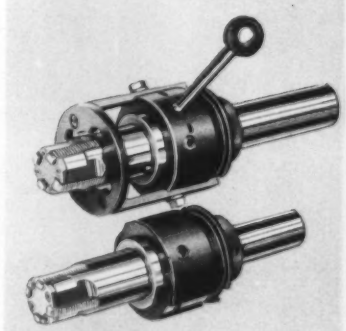
For live spindle or stationary positions. Replaceable shanks permit fast, economical changes from one machine to another. Interchangeability of bodies allows one complete tap and four assembled bodies to cover a size range from 1 3/16" to 3½". Cutting diameters can be varied in exact .001" increments with micrometer control.

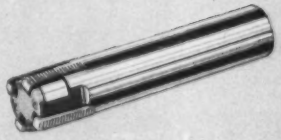
Versatile SOLID ADJUSTABLE TAPS

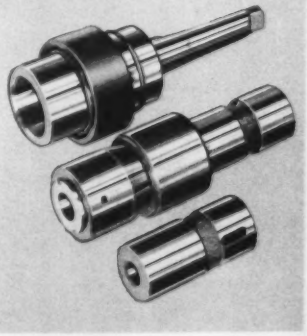
Each tap body has a range of sizes and pitches. Within that range you buy only chasers for each tapping job. The ground thread chasers are removed from the tap body, reground and reset to cut to original size.

Modern-Magic CHUCKS AND COLLETS

Counterboring, drilling, reaming, tapping, etc., can be performed practically without interruption. Tools are quickly and easily changed. The shank and body of the chuck are made from one solid bar of high tensile steel.

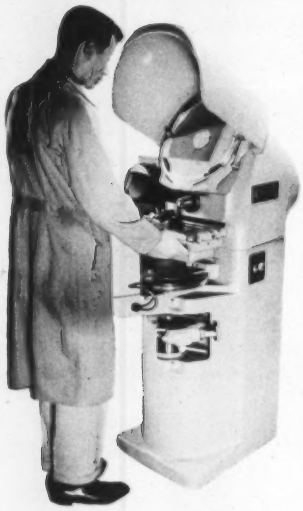




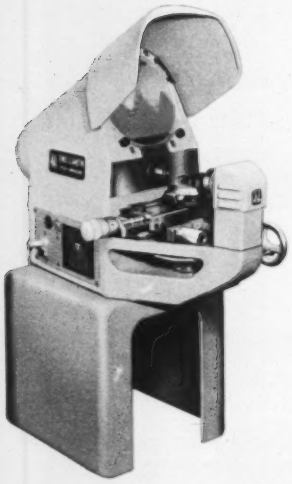


If the J & L general line insert is missing, write JONES & LAMSON, 517 Clinton St., Springfield, Vermont, for your copy.

Model PC-14A



Model TC-10



OPTICAL COMPARATORS & MEASURING MACHINES

Jones & Lamson Optical Comparators Are Unexcelled in Toolroom, Laboratory and Production Inspection.

The most complete, the most versatile Comparator and Universal Measuring Machines.

They precisely measure height, depth, lead or spacing, as well as angles to degrees and minutes.

They compare intricately contoured parts with a master outline — and measure the amount of error.

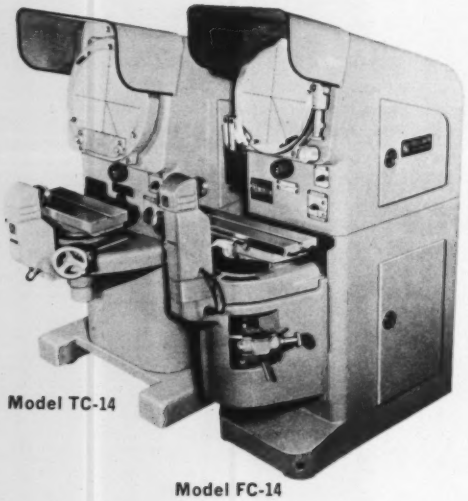
They are convenient to operate and easy to set up and read direct without computation.

They will photograph the enlarged shadow and record its relationship to a master chart.

They will operate under normal lighting conditions. No dark room is needed.

Several persons can study the shadows at the same time.

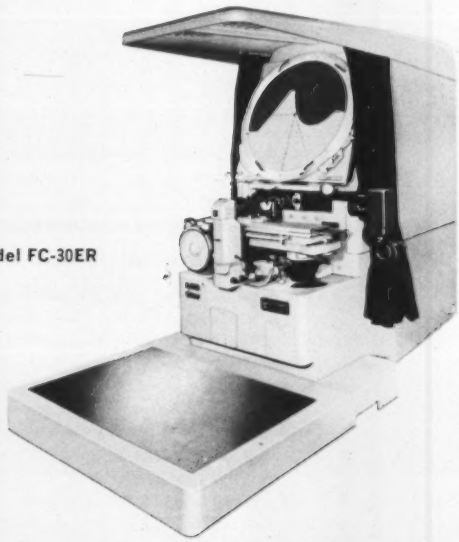
They will inspect and measure surfaces, as well as profiles of objects such as type faces, stamping dies, diodes, recording heads, etc.



Model TC-14

Model FC-14

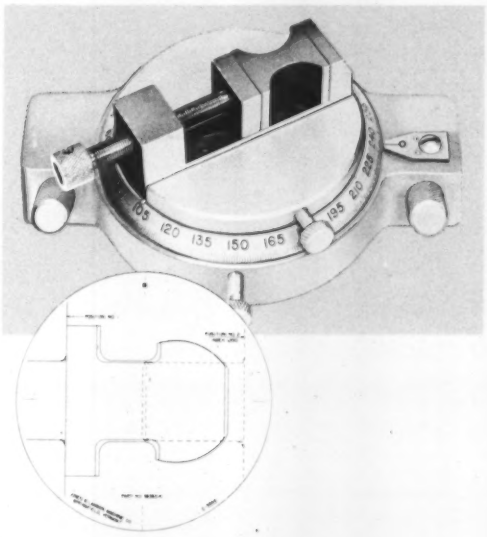
Model FC-30ER



OPTICAL COMPARATOR CHARTS AND FIXTURES

A diversified selection of highly accurate fixtures and glass or plastic Standard Charts are available for all models of Jones & Lamson Comparators.

We have an abundance of the specialized engineering experience necessary to produce almost any conceivable special chart or fixture whose application will fall within the range of our Optical Comparators.

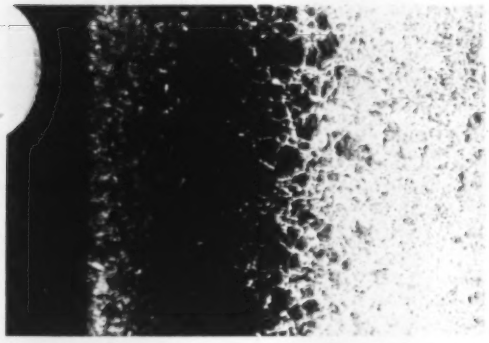


NORMAL REFLECTION ATTACHMENT

The J & L Normal Reflection Unit offers new inspection efficiency and capability to users of J & L FC-14 and TC-14 Optical Comparators.

This new unit is a reflection inspection device, designed to produce the maximum amount of reflectivity, regardless of the surface finish of the part being inspected. Even superficial surface scratches can be checked accurately!

Inspection by reflection and by projection can be done simultaneously, and reflection can be directed from above, below, or either side. A front surface, spherical reflector adds at least 55% to the effective light, by concentrating and redirecting light into the optical system.



This photo taken directly of reflected image of an etched metal sample as it appears on the Comparator Screen with a J & L Photographic Attachment for permanent records.

SUPER HIGH PRESSURE MERCURY ARC LAMP ILLUMINATION

This J & L light source unit for J & L Optical Comparators gives more than 5 times the intensity of the best filament light source available today.

The light produced by the J & L Mercury Arc Lamp is actually a new kind of light . . . you get a steady arc, with no flickering. Its high intensity produces an incomparably bright screen with razor-sharp black shadow even at highest magnifications. Thus, accuracy of inspection and measuring is increased enormously. Now, you can literally "split tenths" with your J & L Comparator! (For use at low magnifications, the Mercury Arc light can be filtered readily.)

The J & L Mercury Arc Lamp comes as a complete packaged unit that is quickly interchangeable with the standard light source on any J & L 14-inch and 30-inch Comparator.

■ *Send leasing information . . . plus . . . catalogs containing complete details on:*

- ☐ Ram Type Universal Turret Lathes
- ☐ Saddle Type Universal Turret Lathes
- ☐ Hydraulic Tracing Attachment
- ☐ Auto Threader
- ☐ Automatic Turret Lathes
- ☐ Numerical Tape Control Turret Lathes
- ☐ Numerical Tape Control Positioning Table
- ☐ Precision Boring Machines
- ☐ Precision Gun Drilling Machines
- ☐ Model 30 Lathes
- ☐ Fay Automatic Lathes and Milling & Center Drilling Machines
- ☐ Automatic Work Handling
- ☐ Thread & Form Grinders
- ☐ Thread Tool Div. Products
- ☐ Optical Comparators & Accessories

NAME .....

TITLE .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

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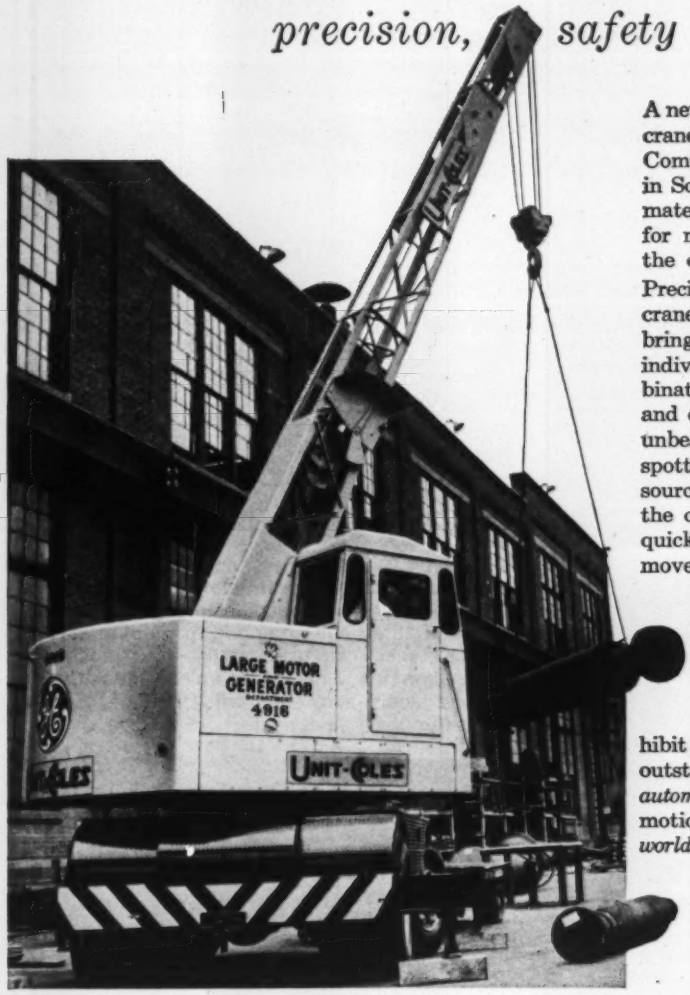
If the J & L general line insert is missing, write JONES & LAMSON, 517 Clinton St., Springfield, Vermont, for your copy.

We have detailed literature on each item shown in this insert.

This new 12-page insert is designed to acquaint you with the performance capabilities of the basic models in Jones & Lamson's world-renowned line of modern metal turning, grinding, inspection and threading equipment. Jones & Lamson Machine Company, 517 Clinton Street, Springfield, Vermont, U. S. A.

Another new UNIT-COLES crane for Major Electrical Manufacturer

Gasoline-Electric Mobile Crane combines unequalled precision, safety and mobility



This UNIT-COLES is assigned to moving raw and in-process material from storage areas at G.E.'s plant. Here, the 12-ton mobile crane with 25-ft. boom is handling rotor shafts to be used in large DC motors. The load weighs 15,700 lbs.

A new UNIT-COLES 12-ton gasoline-electric mobile crane was purchased recently by General Electric Company's Large Motor and Generator Department in Schenectady, N. Y. to move raw and in-process material. Four other UNIT-COLES Cranes are used for materials handling by various department of the company.

Precise control and safety, unequalled by ordinary cranes, are two important benefits a UNIT-COLES brings to yard handling. That's because there are individual electric motors for independent or combination control of *every* function. Electric power and control of load-hoist and boom-hoist means an unbeatable combination for pin-point accuracy in spotting loads. An independent load-hoist power source automatically adjusts all speeds to the load; the crane operator can raise or lower a light load quickly—or ease a heavy load into place so carefully movement is barely visible. The independent swing and travel power sources allow an operator to navigate narrow aisles with ease and speed.

Utmost safety is assured by a positive-action Safe Load Controller with a "stop and hold" function that automatically prevents overloading. Self-resetting limit switches prohibit dangerous over-travel of load and boom. These outstanding safety features together with "fail-safe" *automatic braking* and dead man control on all crane motions contribute to make a UNIT-COLES the *world's safest crane.*

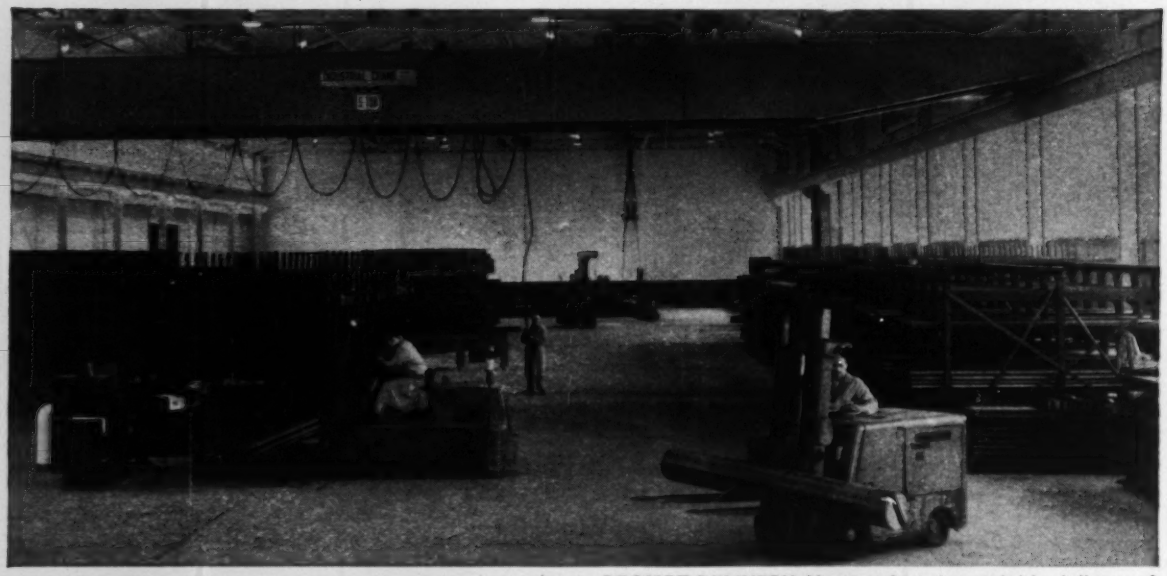
Other important UNIT-COLES advantages are: steering that is "left-for-left" and "right-for-right" whether the boom is over the front or rear of the chassis; unique cantilever boom that allows operation close to stacked material, requiring less aisle room; simplicity of operation — an inexperienced operator learns in a matter of minutes; and low maintenance costs — hundreds of major wearing parts required on other cranes, including clutches and hook rollers, are eliminated.

UNIT-COLES mobile and truck cranes are available in capacities ranging from 5 to 55 tons. Write today for details on the complete line and the name of your nearest dealer.

UNIT-COLES

UNIT CRANE & SHOVEL CORP.
6721 W. Burnham Street
Milwaukee 19, Wisconsin

How Timken® Steel from helps you keep production



PROMPT DELIVERY. You get fast dependable delivery of steel products from your Steel Service Center. It helps you keep production on schedule, meet emergencies. Steel Service Centers are equipped to prepare steel to size required, ready for use, cutting your processing cost. And when it's Timken® seamless steel tubing, graphitic tool steels, alloy steel bars or billets, you can be sure it's the finest steel made.

EXPERT TECHNICAL SERVICE. Your Steel Service Center representatives are experienced, trained to help on your steel applications. And when you buy Timken steel, help is also yours from Timken Company experts—specialists in fine alloy steel for over 40 years. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

CUTS YOUR INVENTORY COST, RELEASES SPACE. Your Steel Service Center stocks a wide variety of steel products. Result—you can reduce your inventory costs, put inventory capital to work elsewhere. And you can release storage space for more productive work.

TIMKEN® *Fine Alloy* STEEL

your Steel Service Center schedules, cut costs

FOR FAST, ABLE SERVICE ON TIMKEN® SEAMLESS STEEL TUBING, GRAPHITIC TOOL STEELS AND ALLOY STEEL BARS CALL THESE STEEL SERVICE CENTERS

LOCATION	STEEL SERVICE CENTER
ALABAMA	
Birmingham	O'Neal Steel, Inc.*†
ARIZONA	
Phoenix	Earle M. Jorgensen Co.*†•
CALIFORNIA	
Los Angeles	Allen-Fry Steel Company*
	Baker Steel & Tube Co. •
	Coulter Steel & Forge Co.*†
	Earle M. Jorgensen Co.*†
	Kilsby Tube Supply, Division of Republic Supply Co. of Calif.•
	Joseph T. Ryerson & Son, Inc.*•
	Service Steel Division Van Pelt Corp.•
	Tube Distributors, California, Inc. •
	Tubesales•
Oakland	Coulter Steel & Forge Company (Emeryville)*†
	Earle M. Jorgensen Co.*†
	Joseph T. Ryerson & Son, Inc.*•
San Francisco	Baker Steel & Tube Co.•
	Earle M. Jorgensen Co.*†
	A. Milne & Co., Inc. (Burlingame)†
COLORADO	
Denver	Earle M. Jorgensen Co.*†•
CONNECTICUT	
Windsor	SAE Steels, Inc.*
GEORGIA	
Atlanta	A. Milne & Co., Inc.†
	O'Neal Steel, Inc.*†
HAWAII	
Honolulu	Earle M. Jorgensen Co.*†•
ILLINOIS	
Chicago	Chicago Tube and Iron Co.•
	Hy-Alloy Steels Co.*•
	A. Milne & Co., Inc. (Melrose Park)†
	The Peninsular Steel Co.†
	Joseph T. Ryerson & Son, Inc.*•
	Service Steel Division Van Pelt Corp.•
INDIANA	
Ft. Wayne	Tubular Sales•
Indianapolis	The Peninsular Steel Co.†
KANSAS	
Wichita	Earle M. Jorgensen Co.*†•
LOUISIANA	
New Orleans	Earle M. Jorgensen Co.*†•
MASSACHUSETTS	
Boston	A. Milne & Co., Inc.†
	Joseph T. Ryerson & Son, Inc. (Allston)*•
MICHIGAN	
Detroit	Alloy Steels, Incorporated†
	A. Milne & Co., Inc.†
	The Peninsular Steel Co.†
	Joseph T. Ryerson & Son, Inc.†•
	Service Steel Division Van Pelt Corp.•
	Tubular Sales•
Grand Rapids	The Peninsular Steel Co.†
MINNESOTA	
St. Paul	Paper, Calmenson & Company*
MISSISSIPPI	
Jackson	O'Neal Steel, Inc.*†
MISSOURI	
St. Louis	Ford Steel Company†
	Joseph T. Ryerson & Son, Inc.*•
NEW JERSEY	
Elizabeth	A. B. Murray Co., Inc.•
Englewood	Tubesales•
Jersey City	Joseph T. Ryerson & Son, Inc.*•
Kenilworth	A. Milne & Co., Inc.†
Linden	Bowsteel Distributors Corporation*
Newark	Faitoute Iron & Steel Company, Inc.*
NEW YORK	
Buffalo	The Peninsular Steel Co. (Tonawanda)†
	Joseph T. Ryerson & Son, Inc.*•
	Service Steel Division Van Pelt Corp.•
Garden City (L.I.)	Tube Distributors Co., Inc.•
New York	A. Milne & Co., Inc.†
NORTH CAROLINA	
Charlotte	Joseph T. Ryerson & Son, Inc.†•
OHIO	
Akron	The Peninsular Steel Co.†
Cincinnati	Ford Steel Company†
	Joseph T. Ryerson & Son, Inc.†•
	SAE Steels, Inc.*
	Service Steel Division Van Pelt Corp.•
Cleveland	A. Milne & Co., Inc.†
	The Peninsular Steel Co. (Bedford Heights)†
	Joseph T. Ryerson & Son, Inc.*•
	SAE Steels, Inc.*
Dayton	Alloy Steels, Incorporated†
	A. Milne & Co., Inc.†
	The Peninsular Steel Co.†
Toledo	The Peninsular Steel Co.†
OKLAHOMA	
Tulsa	Earle M. Jorgensen Co.*†•
OREGON	
Portland	Pacific Machinery and Tool Steel Co.†
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Bristol	A. B. Murray Co., Inc.•
Butler	Keystone Pipe & Supply Co.•
Carnegie	A. Milne & Co., Inc.†
	Joseph T. Ryerson & Son, Inc.*•
McKeesport	A. B. Murray Co., Inc.•
Philadelphia	Capitol Pipe & Steel Products, Inc.•
	A. Milne & Co., Inc.†
	Joseph T. Ryerson & Son, Inc.*•
TENNESSEE	
Chattanooga	O'Neal Steel, Inc.*†
TEXAS	
Dallas	Earle M. Jorgensen Co.*†•
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Houston	Earle M. Jorgensen Co.*†•
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UTAH	
Salt Lake City	Coulter Steel & Forge Company*†
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Spokane	Joseph T. Ryerson & Son, Inc.*•
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London, Ontario	Vanadium-Alloys Steel Canada, Limited†
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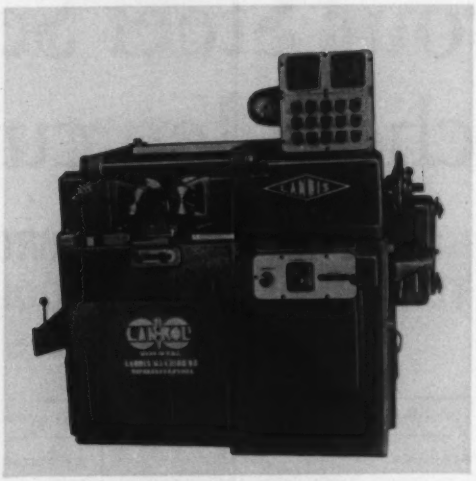
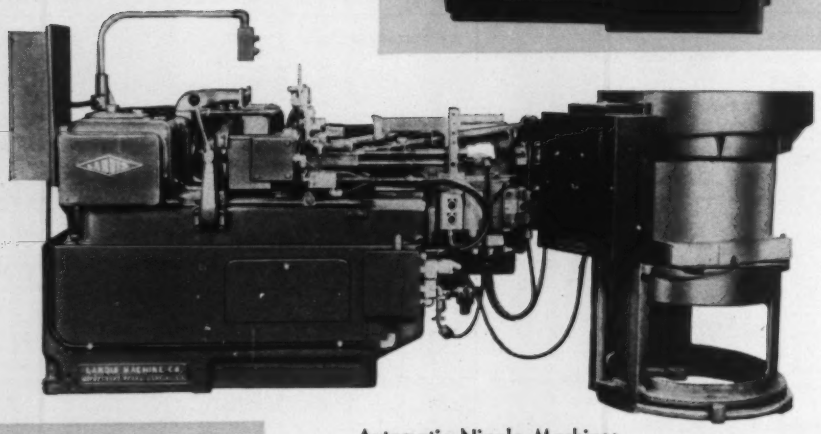
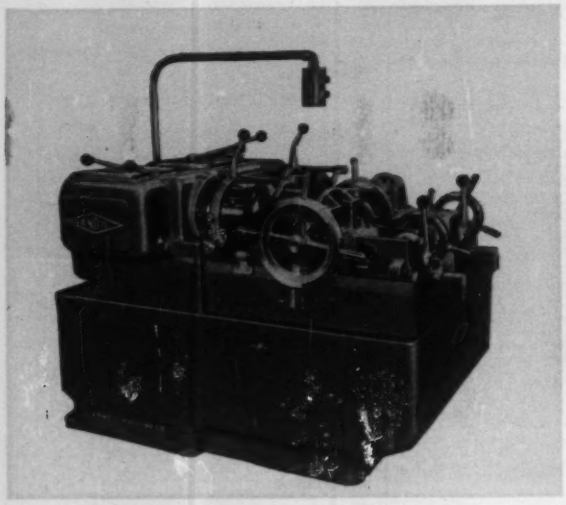
* Alloy Steel Bars and Billets † Graphitic Tool Steels • Seamless Steel Tubing



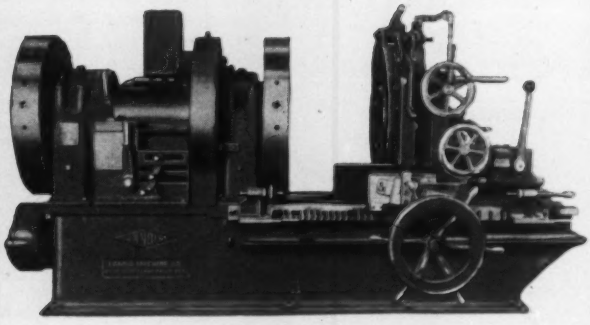
Thread Rolling Machines



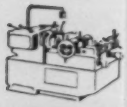
Automatic Nipple Machines



LANDMACO Threading Machines



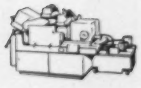
Pipe Threading Machines



Threading Machines

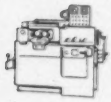
Die Heads—Rotary & Stationary

Taps—Collapsible & Solid Adjustable



Centerless Thread Grinding Machines

Thread Rolling Tools



Thread Rolling Machines

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

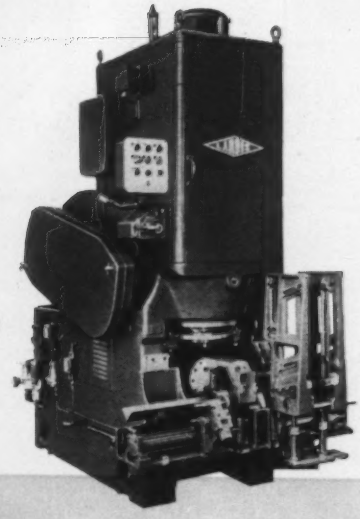
How would you choose a **threading machine?**

Would you consider the results to be obtained first? Or, would you consider how much it's going to cost first? Perhaps your first thought would be to check on the reliability of the manufacturer. Could be you are strictly a name-brand buyer.

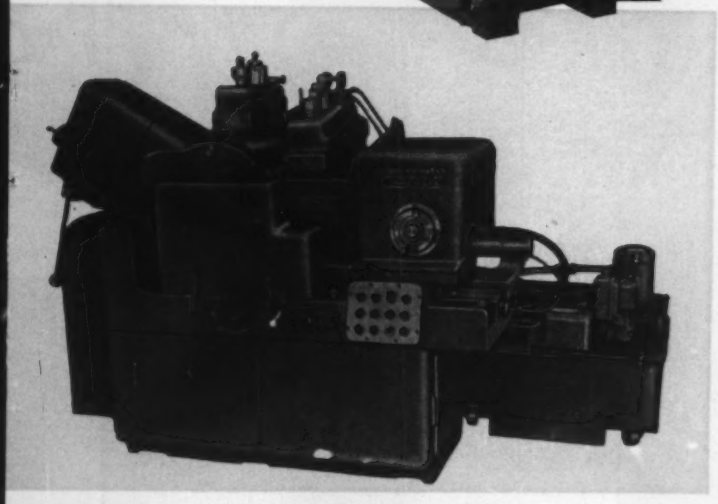
Maybe you choose a threading machine because it has been recommended by a satisfied user such as the Landis Machine Company customer who realized a 90% saving in time threading power screws on a LANDMACO Threading Machine.

How **you** would choose a threading machine of course only you can answer. But doesn't it make good sense to buy from a world leader such as the LANDIS Machine COMPANY? All kinds and sizes of threading machines, thread rolling machines, pipe and nipple threading machines, thread grinders, pipe threading and cutting machines, and automatic coupling tapping machines to meet every threading requirement are available from Landis.

To put the accumulated knowledge of our over 55 years in the threading field to work for you is as close as your phone.



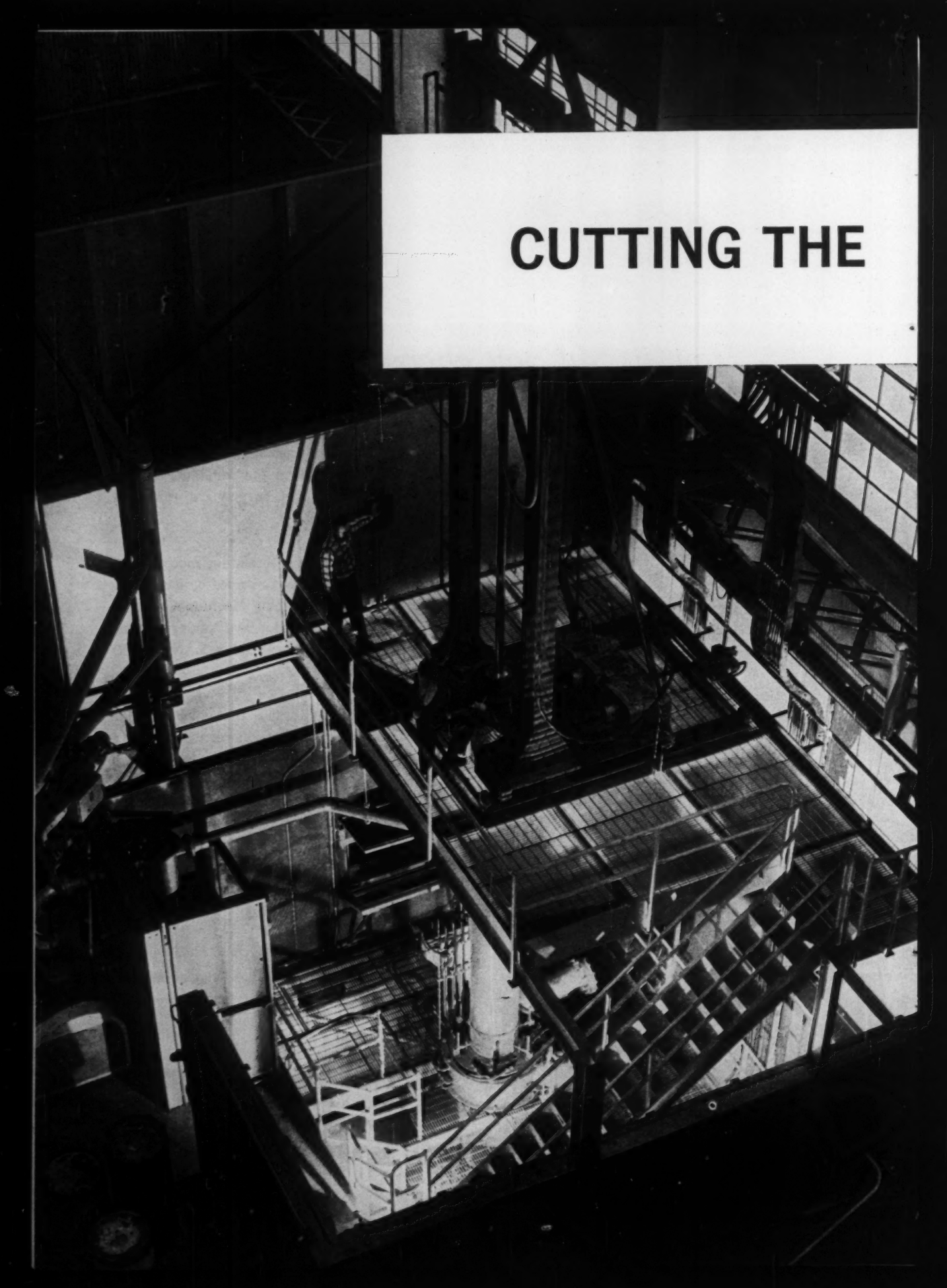
Coupling Tapping Machines



Centerless Thread Grinder

LANDIS *Machine* COMPANY
WAYNESBORO · PENNSYLVANIA

595C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COST OF RELIABILITY

...with 20,000-pound heats of Republic Vacuum-Melted Metal

Processed into billets, sheets, bar, strip, or wire, vacuum arc melted metals are being delivered in quantity, on time, at reasonable cost.

To minimize the cost, Republic produces vacuum-melted metals in larger melts—4,000 to 20,000 pounds. Integrated facilities process 18- to 32-inch diameter ingots into a wider range of product sizes and conditions than ever before possible.

Republic's consumable electrode vacuum-melting process improves mechanical properties—tensile strength, ductility, fatigue life, and performance at high and low temperatures. Precise control reduces nonmetallic inclusions and harmful gases.

Our metallurgists will help you select and apply the vacuum-melted metal best suited to your requirements: *constructional alloy steel, high strength alloy steel, bearing steel, stainless steel, super alloy steel, titanium, or special carbon steel.* For information, contact your nearest Republic sales office or mail the coupon.

CONSTRUCTION ALLOY STEELS • HIGH STRENGTH STEELS • BEARING STEELS • STAINLESS STEELS
SUPER ALLOY STEELS • TITANIUM • SPECIAL CARBON STEELS

REPUBLIC

PH STAINLESS STEELS . . .

Type PH 15-7 MO for missiles and aircraft offers high ultimate tensile strength with excellent mechanical properties to 1000°F. Type 17-4 PH for shafts, gears, pins and other components requires only a one-hour heat treatment at 900°F to develop its full strength (ultimate tensile strength to 200,000 psi). Type 17-7 PH for pressure tanks, bellows, springs, and other applications provides better corrosion resistance than the hardenable grades of chromium stainless. Send for PH Stainless Steel Booklet.

Strong, Modern, Dependable

REPUBLIC STEEL

Cleveland 1, Ohio

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. ST-1590
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:
- ☐ Republic Vacuum-Melted Metals
- ☐ PH Stainless Steel
- ☐ Have a metallurgist call

Name_____ Title_____

Company_____

Address_____

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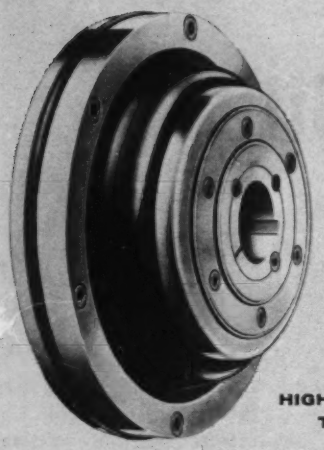
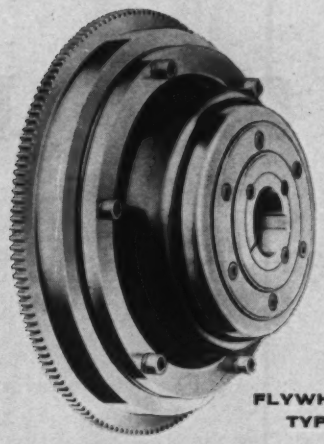
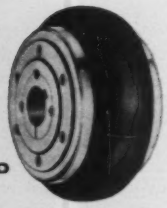


HIGH SPEED TYPE



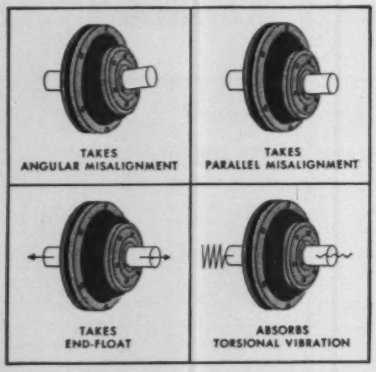
FLYWHEEL TYPE

NOW! THE COUPLING WITH THE 4-WAY FLEX IN TWO NEW TYPES — HIGH SPEED AND FLYWHEEL



STANDARD TYPE

THE 4-WAY FLEX OF PARA-FLEX



DODGE **Para-flex**

Industry asked for this—and here it is! Dodge Para-flex, the unique coupling that swallows up misalignment, is now available for high speed applications, and for high torque at either high or low speed.

The new Dodge High Speed Para-flex is specially designed for operation with motors and internal combustion engines that turn up to 5230 rpm.

The new Flywheel Para-flex, with the same capabilities, has a flexing element that bolts directly to the flywheel of internal combustion engines.

Like the Standard Type (with capacities up to 2000 hp at 1080 rpm) these new Para-flex Couplings feature a modern, tire-like flexing element that handles angular and parallel misalignment, end-float (or any combination) and absorbs torsional vibration. The amazing performance of Para-flex Couplings is a matter of record in thousands of installations.

Ask your Dodge Distributor—or write us for new technical bulletin.

DODGE MANUFACTURING CORPORATION
4400 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Equipment."

When you think of
FLEXIBILITY

Lucas provides

Lever control.

Pendant control

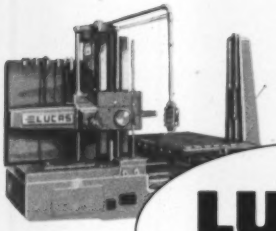
Tape control

and a variety of combinations of the three for flexibility of control suited to the type of work required.

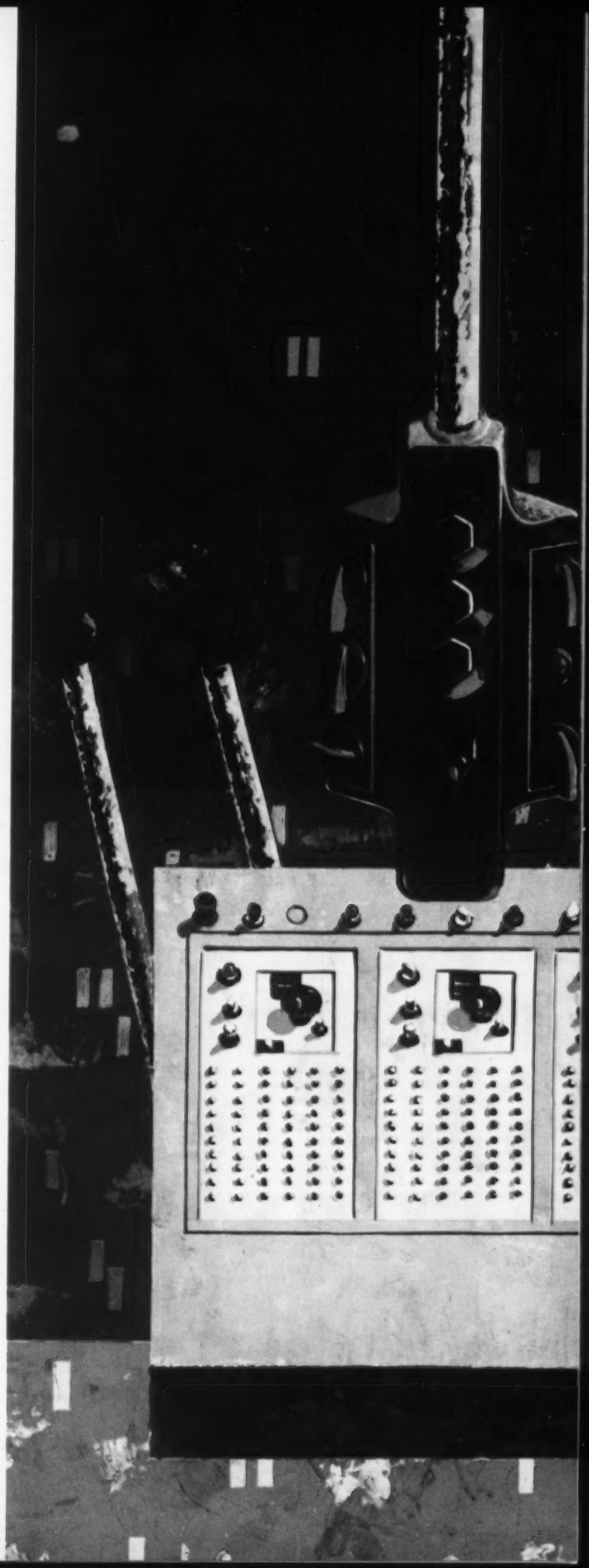
For example . . . The Multiple Control Pendant selects speeds, feeds, unit travels, rapid traverse of head, table, saddle and spindle, plus the rotation of the spindle forward and reverse, jog and stop. Speeds and feeds can be pre-selected while the machine is in operation.

Practical applications of these controls are spelled out in a new catalog. Write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of flexibility . . .

think of . . .



LUCAS
PRECISION



When you think of VERSATILITY

Lucas feeds the saddle ⇐

Lucas feeds the spindle ⇒

Feeds both in combination ⇒ ⇐

when necessary.

Combine these motions with

Vertical spindle head travel ⇕

and horizontal table travel ⇔

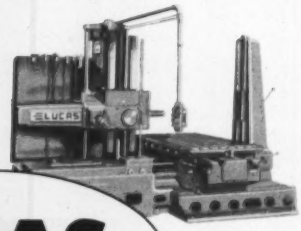
and a rotary table ↻

if you need it.

The result . . . no machine tool can offer a greater combination of usable motions for boring, drilling, milling and related work.

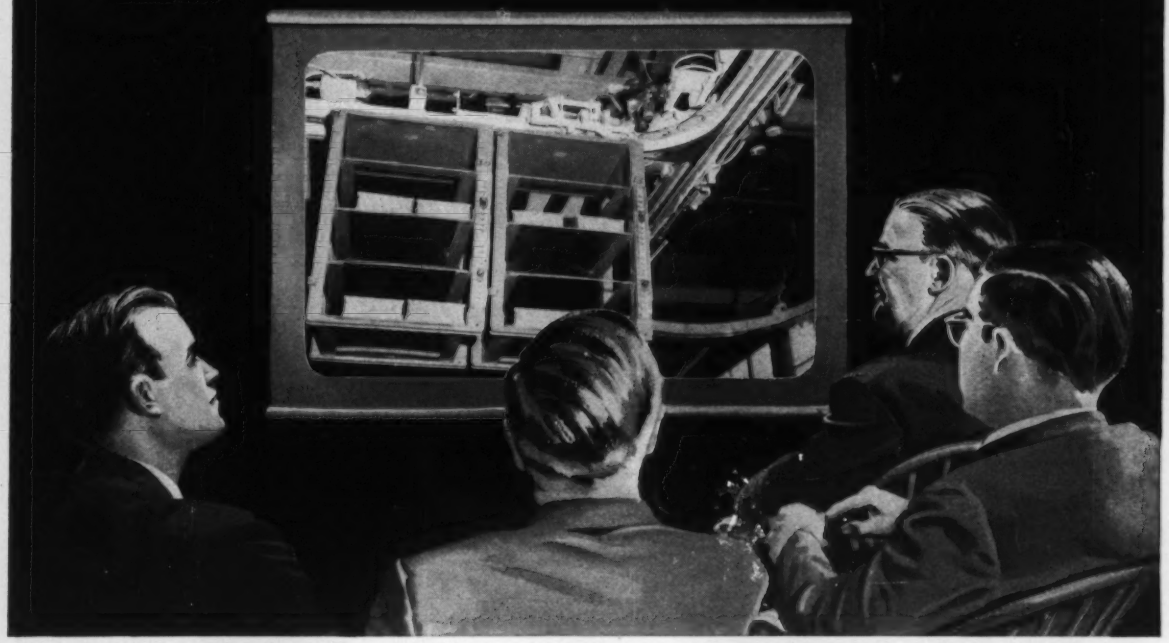
Over twenty models and a dozen major attachments. Write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of versatility . . .

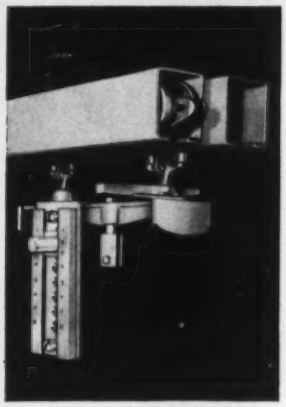
think of . . .



LUCAS
PRECISION

See the cost-saving advantages of an R-W "TWIN-TRAK" OVERHEAD AUTOMATIC DISPATCH SYSTEM demonstrated in your office!





An R-W "TWIN-TRAK" Overhead Automatic Dispatch System consists of one or more Power Track and as many Storage or Load Tracks as desired plus Switches, Carriers, Accessories and Power Equipment. "TWIN-TRAK" Systems are economical to install and maintain . . . easy to expand, alter or relocate as necessary.

The handling ot materials offers American industry its greatest cost-cutting frontier and reduced costs will be accomplished only with a "true" integrated materials handling system that coordinates all production functions on a plant wide basis. A new movie has just been produced that graphically demonstrates how R-W "TWIN-TRAK" Automatic Dispatch Systems meet this need. "TWIN-TRAK" is a completely automatic conveying system that selectively conveys parts, components and products throughout all production processes. Parts and components may be inventoried in overhead storage banks and then automatically selected and transported *where* they are needed—*when* they are needed. Write today to arrange for a showing of this film in your office.

Richards-Wilcox

MANUFACTURING COMPANY

MATERIALS HANDLING DIVISION

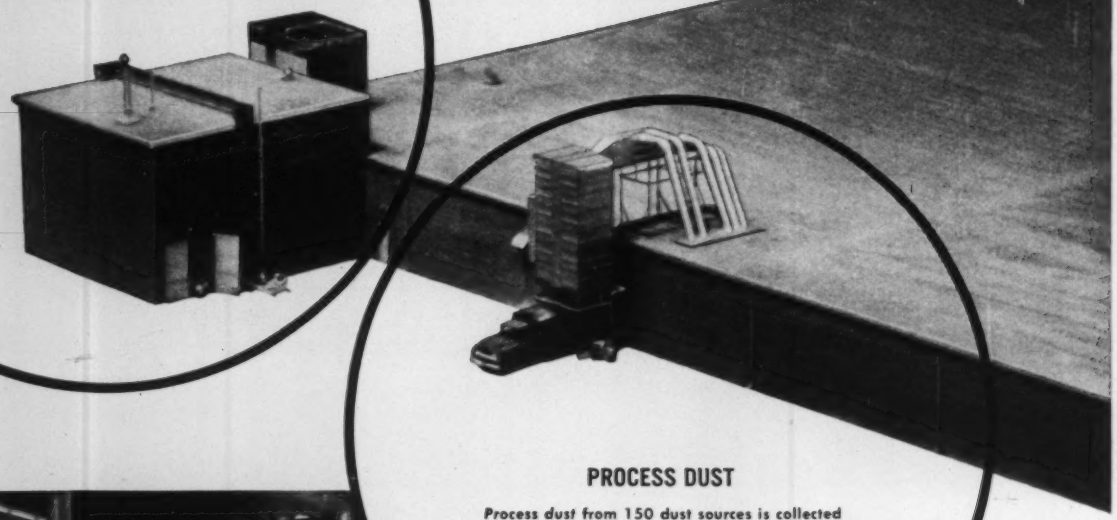
468 W. THIRD ST. • AURORA, ILL. • Branches in all Principal Cities

AAF clean-air engineering makes

...*despite*

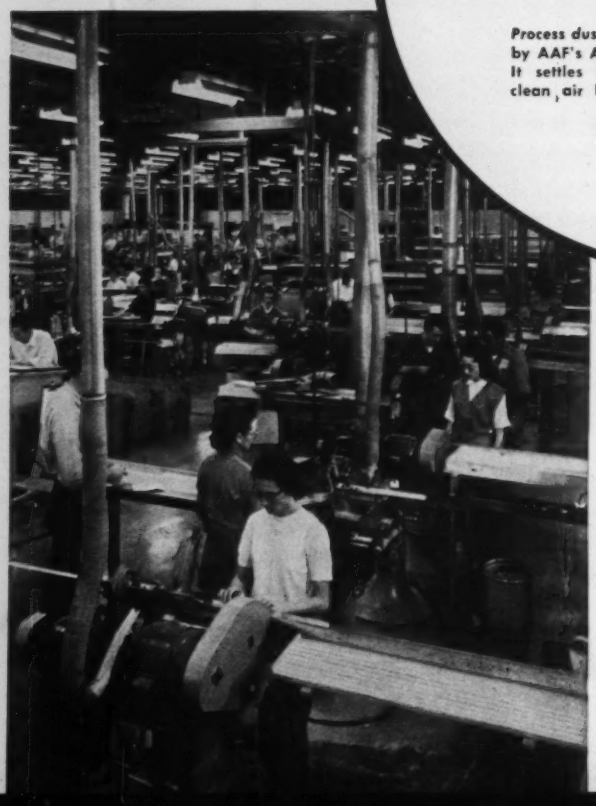
ATMOSPHERIC DUST

Atmospheric dust **is taken out of the intake air by AAF's Roll-O-Matic air filter located in the air conditioning apparatus room. Recirculated ventilation air also is continuously cleaned by the Roll-O-Matic.**



PROCESS DUST

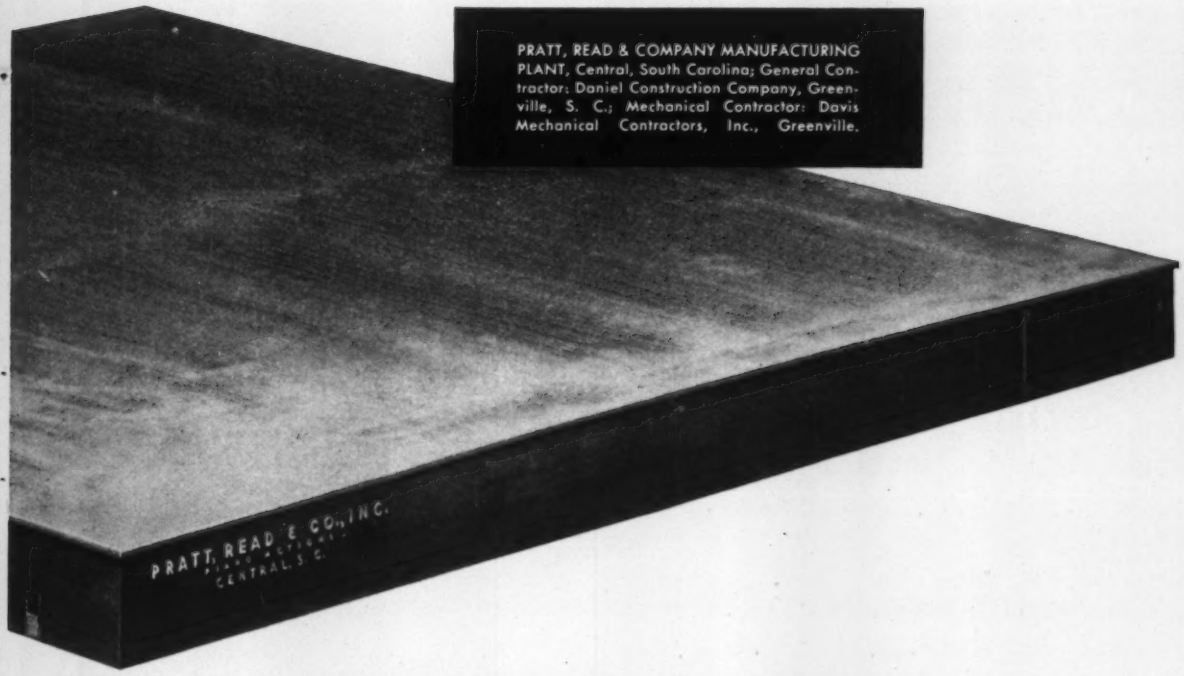
Process dust **from 150 dust sources is collected by AAF's AMERjet reverse jet fabric collector. It settles the dust in its hoppers, returns clean air back through the central system.**



Interior of plant showing multitude of dust-producing operations.

air conditioning practical here...

150 dust-producing operations going full blast!



PRATT, READ & COMPANY MANUFACTURING PLANT, Central, South Carolina; General Contractor: Daniel Construction Company, Greenville, S. C.; Mechanical Contractor: Davis Mechanical Contractors, Inc., Greenville.

AAF system permits air recirculation, slashes heating-cooling, maintenance costs

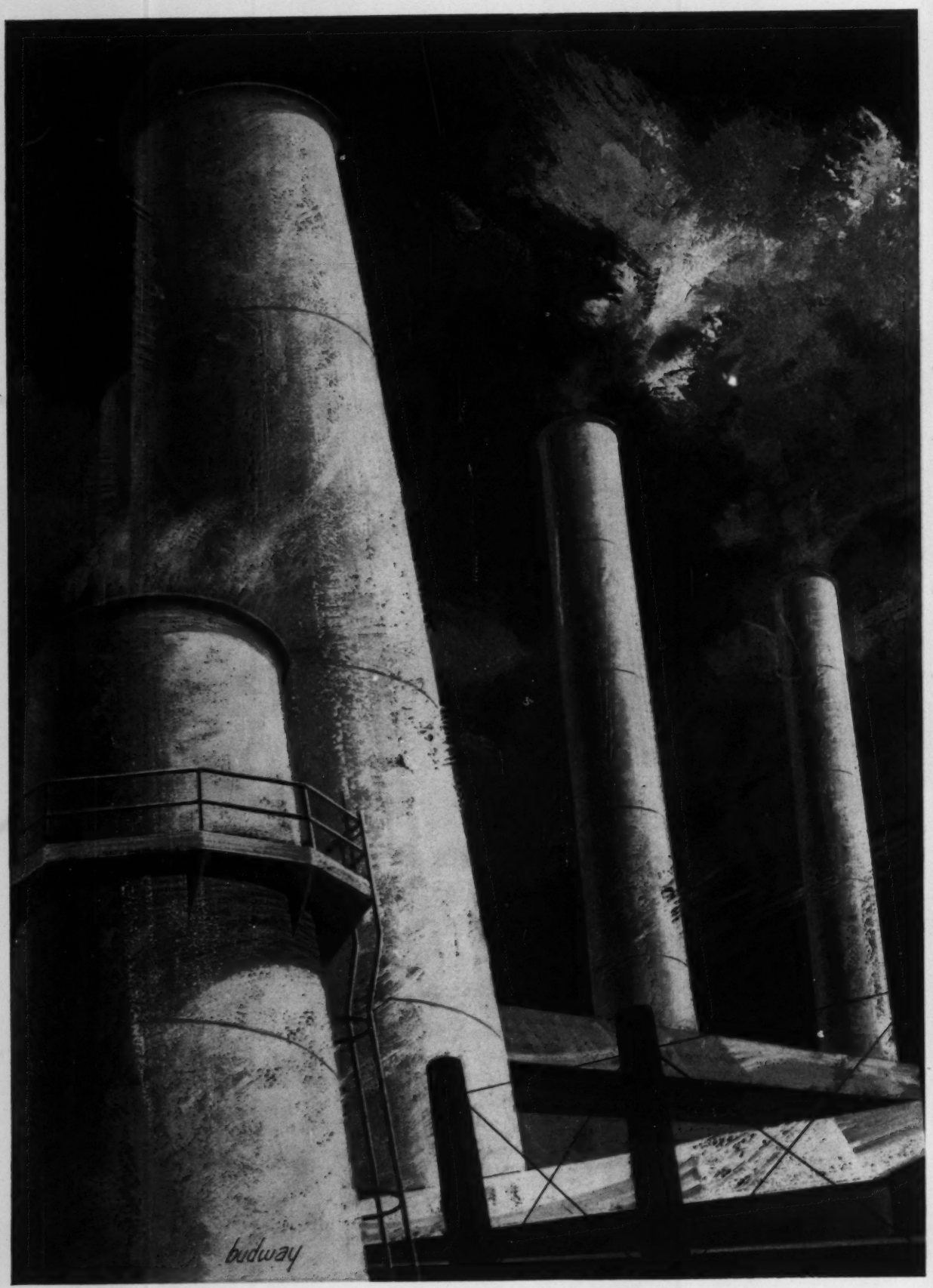
Pratt, Read & Company, manufacturers of piano keys and actions, wanted its new Central, South Carolina plant to be air conditioned. Reasons: better working environment for its people and improved quality of its products. Problem: the fact that 150 dust-producing operations would be going at full throttle during the working day.

AAF's air engineering knowhow, plus its complete line of air-cleaning products (for both atmospheric and process dust) made air conditioning practical by providing for money-saving recirculation of air. The savings: plenty—lower heating costs in winter, vastly lower cooling costs in summer, and a big savings in plant cleaning costs.

For a look at what we mean by a really *complete* line of equipment, call your local AAF representative or write direct for Bulletin 518. Address: Mr. Robert Moore, American Air Filter Company, Inc., 443 Central Ave., Louisville, Ky.

AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS


budway

Did you know there is a guaranteed way to clean stack gases?

Cleaning your gases is not a simple task. A careful analysis must be made of flue gas temperature, dust composition, and such things as dust loadings and gas volume. It takes a real crew of experts to make sense out of the data, then design, manufacture, and install equipment with *guaranteed* gas-cleaning efficiency.

Koppers has over 50 years of industrial gas-cleaning experience. They're experts. Koppers designed and installed the first successful electrostatic precipitators for hot metal open hearth furnaces.

Two Koppers divisions work cooperatively to provide effective gas-cleaning installations. The Engineering and Construction Division can design and install a gas-cleaning system which will eliminate fumes, acid mist, ashes, or dust, as well as recover valuable materials at low cost per cubic foot of gas processed. Precipitators made by the Metal Products Division can be used with any steelmaking or ironmaking furnace, and they operate at close to 100% efficiency, with very little maintenance required.

Two outstanding examples of Koppers installations are the open hearth furnaces at Fairless Works of United States Steel Corporation, and the blast furnaces at Great Lakes Steel Division of National Steel Corporation. A completely different system was designed and installed by Koppers for the McLouth Steel Corporation. Here, they used pressure-type disintegrators to clean gases from electric furnaces and new oxygen converters. It proved efficient for both steelmaking processes. And Koppers is now installing seven additional electrostatic precipitators and ten additional waste heat boilers to control the gas discharge from open hearth furnaces at the Pittsburgh Works of Jones & Laughlin Steel Corporation.

Koppers will be glad to analyze your operation, too. Write to Koppers Company, Inc., Engineering and Construction Division, Pittsburgh 19, Pennsylvania.

KOPPERS® ENGINEERING and CONSTRUCTION

How to achieve higher cost-reduction objectives with new bench-type hydraulic Multipress®

By: J. S. Tipton

Multipress Product Manager
Denison Engineering Division
American Brake Shoe Company

Utilizing the inherent smoothness, speed and accuracy of controlled hydraulic power, this new Denison "R-S-T" Series Multipress opens up important new opportunities for cutting production costs on virtually every type of pressing operation. Punching, riveting, assembling, staking, forming, marking and trimming are only a few of the numerous production jobs Multipress can perform faster, more accurately and at lower cost.

The advanced design features described below make this new Multipress a versatile cost-reduction tool on both small lots and high production runs.

Because it is so compact and requires so little space, Multipress is ideal for a continuous line operation where a series of presses is run side-by-side. For automatic operations, Multipress can be mounted around dial tables, feed mechanisms and indexing fixtures to keep tooling costs to a minimum. And controls can be actuated automatically from external sources, making it easy to interlock Multipress with other automated production operations.

CLEAN, COMPACT DESIGN

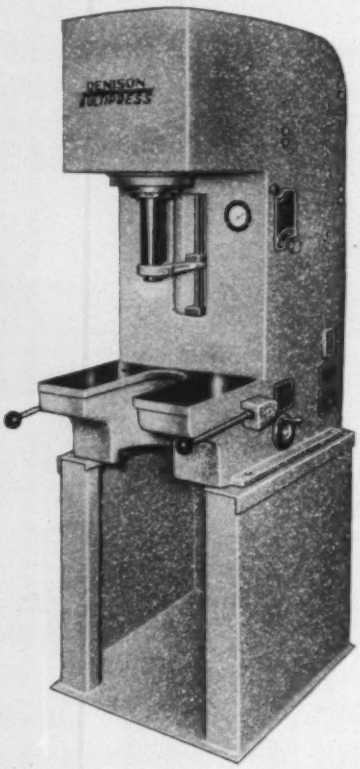
The cutaway illustration on the opposite page shows the basic components of the new Multipress. These include the frame, oil reservoir, hydraulic pump and its electric motor, and the ram-and-cylinder assembly. Note the rugged, extremely simple and compact design.

Briefly, here's how the Multipress operates: The electric motor drives a balanced-vane, cartridge-type hydraulic pump, which draws oil from the reservoir and delivers it under pressure to the ram-action control valve. The valve is actuated when the operator depresses the dual control levers. Oil under pressure flows into the top of the cylinder, forcing the piston and ram down on the work. Ram action is non-rotating, shockless and quiet. When the control levers are raised, oil flows through the lower cylinder port, forcing the piston and ram upward. High-fidelity control of ram speeds, pressures, strokes and ram action is accomplished manually, automatically or electrically by using any one of 18 different operating and basic control valves. The Multipress unit is complete with self-contained piping, control and power circuitry.

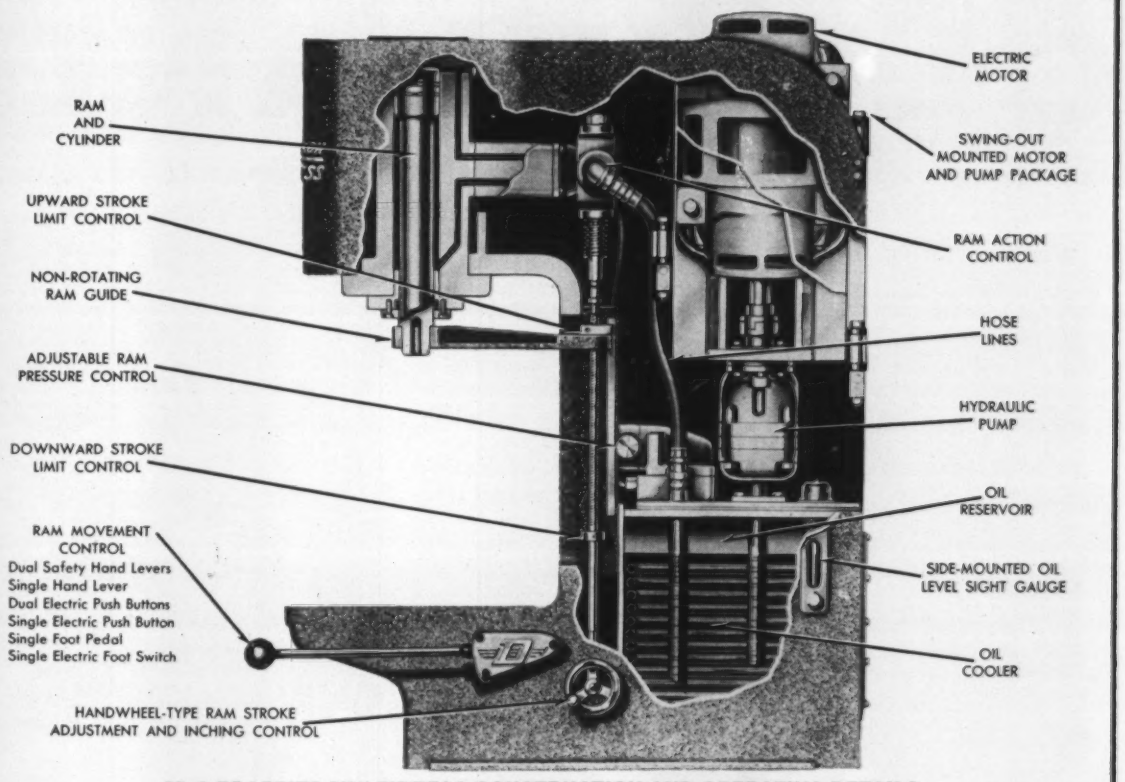
ADVANCED FEATURES

An important consideration in the selection of a Multipress is its *rapid ram approach* feature. The true productive time of a press is only during the actual pressing stroke. Multipress *reduces non-productive time 85%* by increasing the speed of ram approach and ram return. This time-saving allows more cycles-per-minute, more pieces-per-hour—and can result in significantly lower unit production costs.

Another cost-reduction benefit is afforded by faster, simpler tooling and set-up. Greater daylight, larger bed area and throat dimensions provide easy access to tooling. The task



COMPLETELY NEW IN DESIGN. *"R-S-T" Series Multipresses are available in three size and capacity ranges: "R"— 1 to 6-tons, "S"— 3 to 8-tons, "T"— 4 to 12-tons. Unit above is shown mounted on optional bench accessory.*



"R-S-T" SERIES MULTIPRESS CONSTRUCTION AND OPERATING DETAILS

of mounting and setting the press tooling is simplified considerably. The handwheel-type ram stroke adjustment and inching control quickly set the upper limit of the ram stroke, and allow the operator to "inch" the ram to the work under controlled pressure with high accuracy.

SAVES OPERATOR TIME AND WORK

A control knob, conveniently located on the side panel of the press, permits quick adjustment of ram pressure. This arrangement is a great saver of spoiled work and lost time during set-up operations. The operator simply checks the pressure gauge to determine working pressure necessary to accomplish the job. By adjusting the control to that pressure, the ram will travel no further after the work is accomplished. This prevents harmful pressures from being exerted on individual pieces of work even though they may vary in size.

A pushbutton valve for the pressure gauge provides instantaneous check of ram pressure, and keeps the gauge out of the circuit during pressing operations for maximum gauge protection and long life.

BUILT TO J.I.C. STANDARDS

The "R-S-T" Series Multipress is designed to J.I.C. specifications. The swing-out, J.I.C.-mounted motor and pump package make it easy to inspect and service the press. Because the motor and pump are mounted on a single, vertical bracket hinged to the press frame, *quick accessibility to all controls* is possible by simply swinging the complete motor and pump unit out of the frame housing.

The Multipress frame itself is rigid, multi-piece welded steel construction. It is designed and fabricated for .001" deflection per ton.

Both the base and the press bed are recessed to provide more knee room for the operator. All operating and adjustment controls are located "up front" for greater operator efficiency.

In the Denison Multipress design, precision control of ram speeds, ram pressures, ram strokes, ram actions—means tremendous press *versatility* and insures complete uniformity of finished work regardless of variations in work sizes, materials, work positioning or other variables.

A complete line of tailored accessories is available for use with "R-S-T" Series Multipress, including benches, bolsters, index tables, feed mechanisms, touch control and knockout rams.

WRITE FOR FREE CATALOG

Operating data and specifications on the new "R-S-T" Series Multipress, plus information on the complete line of other one to 100-ton capacity Multipress units, are available from your nearby Denison hydraulic press specialist. Call him, or write to us for Bulletin 324 and the new 26-page Catalog 120.

DENISON ENGINEERING DIVISION

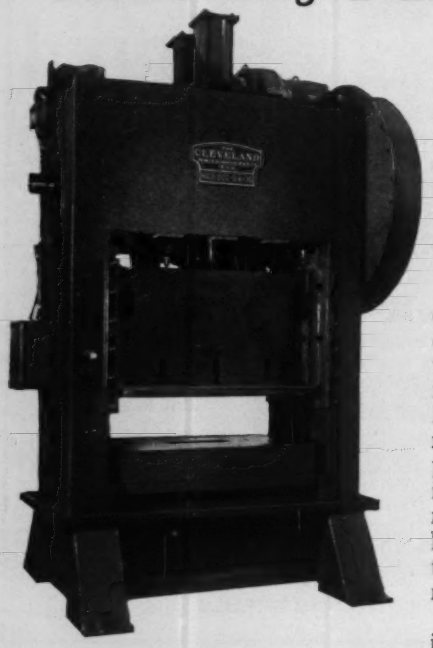
American Brake Shoe Company

1180 Dublin Road • Columbus 16, Ohio

For Greater Economy In Metalworking

CLEVELAND

Cost-Cutting PRESSES

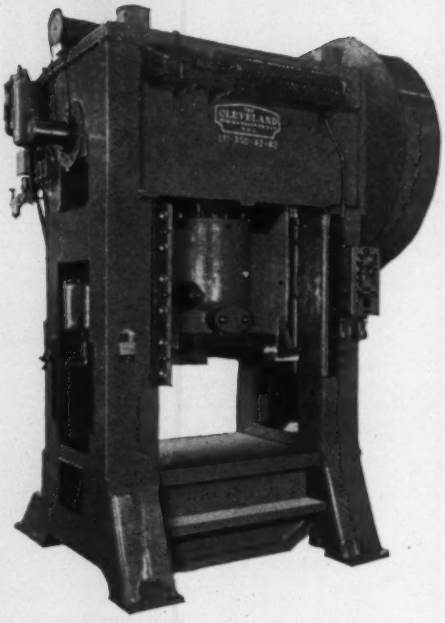


Cleveland high-speed Double Eccentric Press, 200-ton capacity, operates at 50 to 150 strokes per minute for high-speed punching, shearing, perforating, bending and forming.

Are production breakdowns, slow outmoded presses and mounting maintenance costs destroying your profits? A check of your press performance records may show you're already paying for new presses . . . *without their benefits.*

For lower operating costs, quicker starting, increased production, investigate the new minimum-maintenance Cleveland Presses. Our engineers are ready to help you plan a program of replacing old inefficient presses with modern cost-cutting Cleveland Presses of the exact type, size and capacity to meet your need.

You get better stampings for less with a Cleveland Press.



Cleveland's cost-cutting Single Eccentric Press, 350-ton capacity, operates at 60 strokes per minute, has air-counterbalanced slide and auxiliary air brake on flywheel.

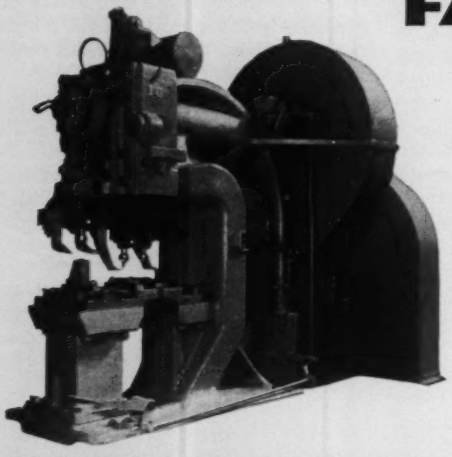
FABRICATING TOOLS

For Plate and Structural Steel

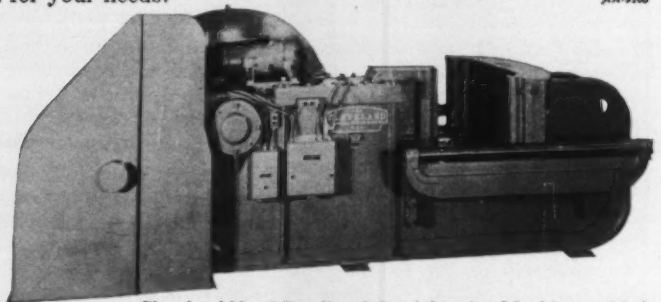
Ruggedly built for profitable production and simplicity of operation, Cleveland Fabricating Tools are designed for trouble-free operation and years of service—a fact proven by leading shipyards, bridge builders, railroads, structural shops and boiler makers since 1880.

For punching, coping, notching, shearing, bending and planing I-beams, steel plate, bars, angles and other structural shapes, you can do it better, more economically with Cleveland Fabricating Tools. Write for Catalog #9 to help you determine the correct tool for your needs.

AA-9105



Cleveland I G Beam Punching Machine equipped with 3 gaged punching attachments, one high and two low die holders, 24″ throat, completely enclosed gears and flywheel, punching capacity: standard 6″ to 24″ I-beams in flange and web. Other capacities and sizes available.



Cleveland No. 2 Bending & Straightening Machine, welded steel frame, completely enclosed gears and flywheel, arranged for direct-drive motor and equipped with power adjustment to plunger through separate motor. Capacity: bend or straighten 24″ I-beams vertically or horizontally.

THE CLEVELAND PUNCH & SHEAR WORKS CO.
Established 1880

Power Presses
Fabricating Tools
Punching Tools & Dies

E. 40th and St. Clair Avenue, Cleveland 14, Ohio

J & L's new Cleveland warehouse speeds service with ultramodern equipment.

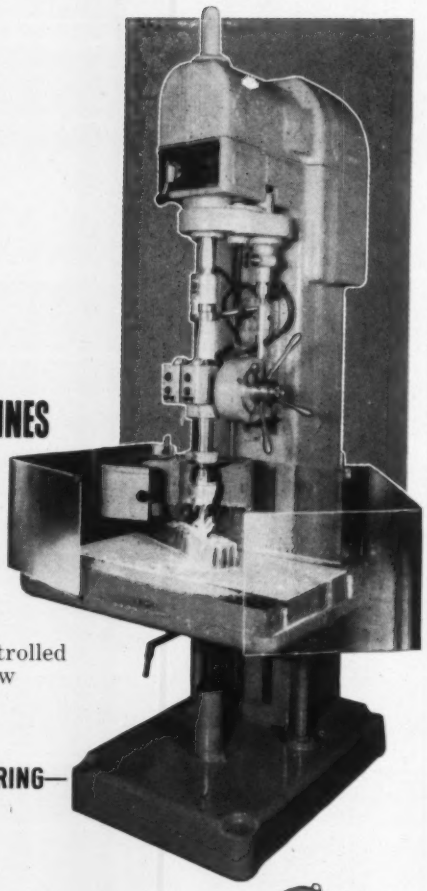
J & L Steel Service Centers—efficient and dependable. Ultramodern equipment at the Department Stores of Steel pays you extra dividends. This Trak-Rak, for example, is a super filing cabinet with 1350 drawers for storing cold finished bars and tubing—the most efficient setup of its kind. Equipment like this, unparalleled expansion, new buildings, the latest machinery and ready-to-go stocks of carbon steel, special steels and stainless—all add up to faster, more efficient service for today's J & L customers.

Take advantage of the streamlined, time-saver service J & L offers. Count on the Department Stores of Steel. You'll get exactly what you want—when you want it.

J & L Steel Warehouse Division

CHICAGO • CINCINNATI • CLEVELAND • DETROIT
HAMMOND • INDIANAPOLIS • LANCASTER • LOUISVILLE • MEMPHIS
NASHVILLE • NEW ORLEANS • NEW YORK • PITTSBURGH

GET MORE DONE IN '61 WITH THESE 'BUFFALO' MACHINES



NEW DRILLING CAPACITY, RANGE AND CONVENIENCE

Long a favorite for production and tool room because of its variable speed control and its unusual quality construction, the "RPMster" keeps up with space-age requirements. 1", 1½" and 2" sizes covers most drilling ranges. New torque-controlled power feed prevents overloading machine and tools. Special hollow spindle drills new super-hard exotic metals as well as ceramics. Ask for sensational production records.

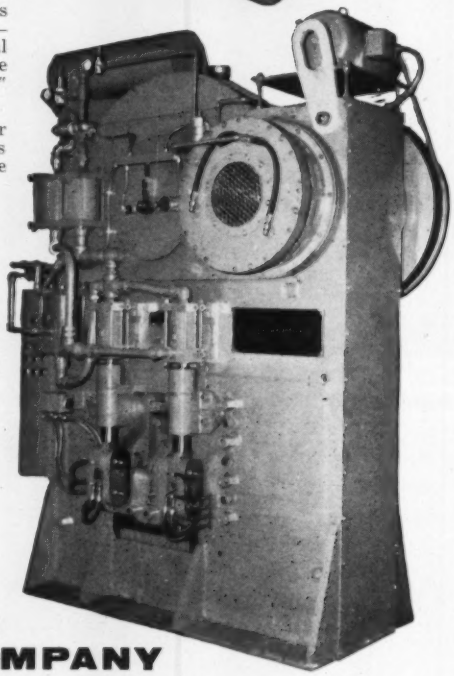
COLD PRODUCTION BENDING WITHOUT DIES

'Buffalo' Bending Rolls turn out commercially accurate circles, arcs, spirals from almost any structural shape—at production speeds. Setup is rapid. Rolls are released by hydraulic roll lift. Standard or special rolls are quickly changed and adjusted to desired radius. New, compact speed reducer saves floor space. Handy controls. Vertical and horizontal models.

PRODUCTION BILLET SHEARING—CLEAN, SQUARE CUTS

'Buffalo' Billet Shears turn out more billets per hour — produce sharp, smear-free cuts that do not conceal porosity—give you absolute dimensional uniformity. A complete range of models to handle up to 10" rounds.

This new "400" shear, for example, operates at speeds up to 60 strokes per minute —cuts any shearable material up to 4½" rounds or 4" squares. Available with automatic feed tables for sustained production speeds. Rigid alloy steel frame, electrical controls, air-operated automatic oiling system—all the quality features for long life and freedom from troubles. You've got to see this one in operation.



Contact your local 'Buffalo' Machine Tool Representative for details on these production-boosting, cost-cutting machines!

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

MACHINE TOOL DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

STEELMAKING AT JESSOP

Experience counts . . . and Jessop has it

There is no substitute for experience in making steel for the reactors of nuclear submarines like the Nautilus, the Skate and the Polaris-firing George Washington. Jessop's activity in nucleonics dates back to the early days of the Manhattan Project.

Today, Jessop's still at it—continuing research, improving techniques, piling up experience in making sophisticated steels to harness the atom. And Jessop is out front in other steelmaking fields too.

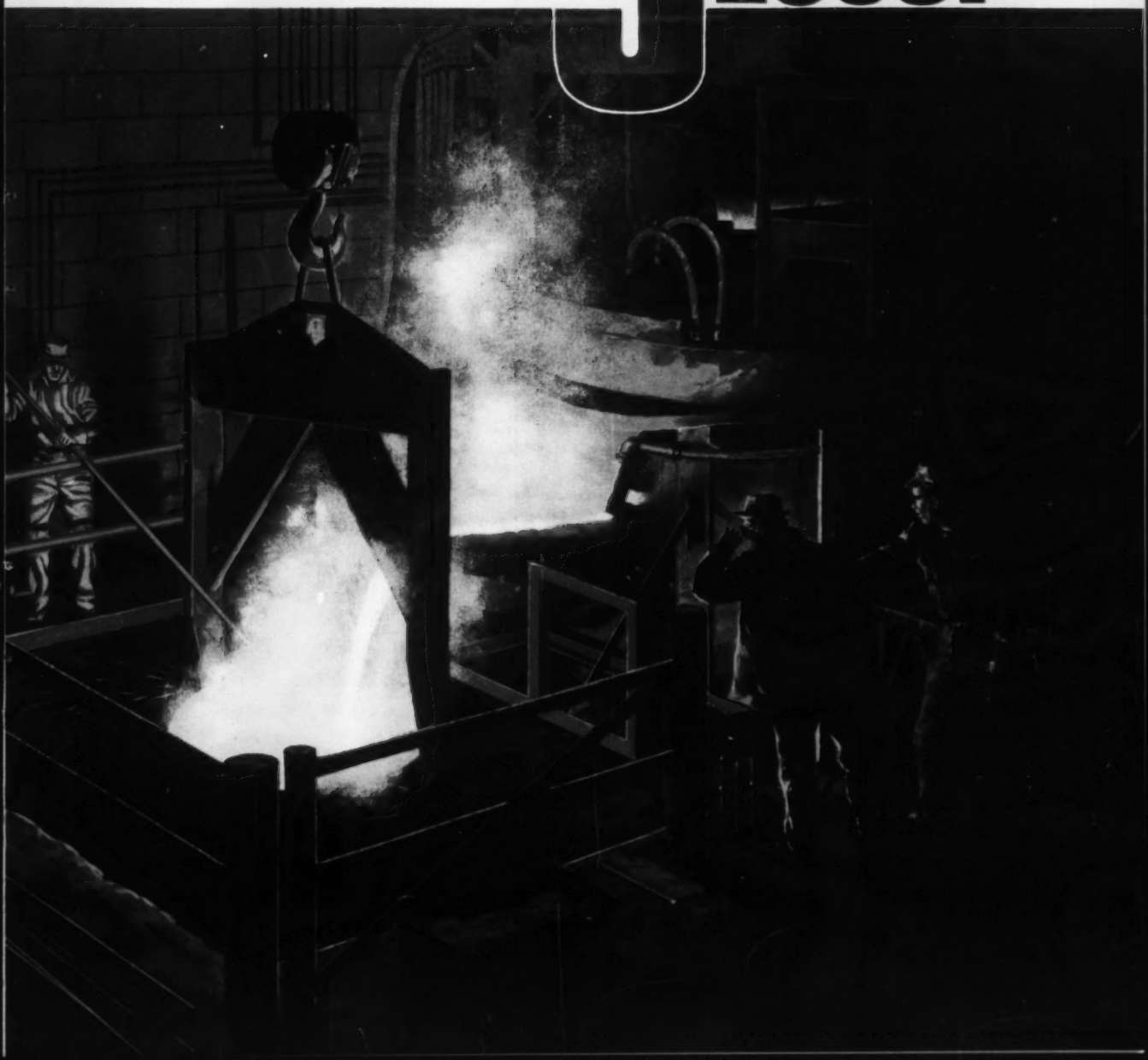
Whether you use heat- or corrosion-resistant stainless steels; abrasion- or shock-resistant steels; nonmagnetic or precision ground steels; high speed, cast-to-shape, clad or alloy steels, you can be sure of the quality—and *service*—you'll get when you do business with Jessop.

In quality steelmaking experience counts, and Jessop has it. Call a Jessop sales office in any of 23 major cities of North America and discuss *your* needs for specialty and alloy steels.

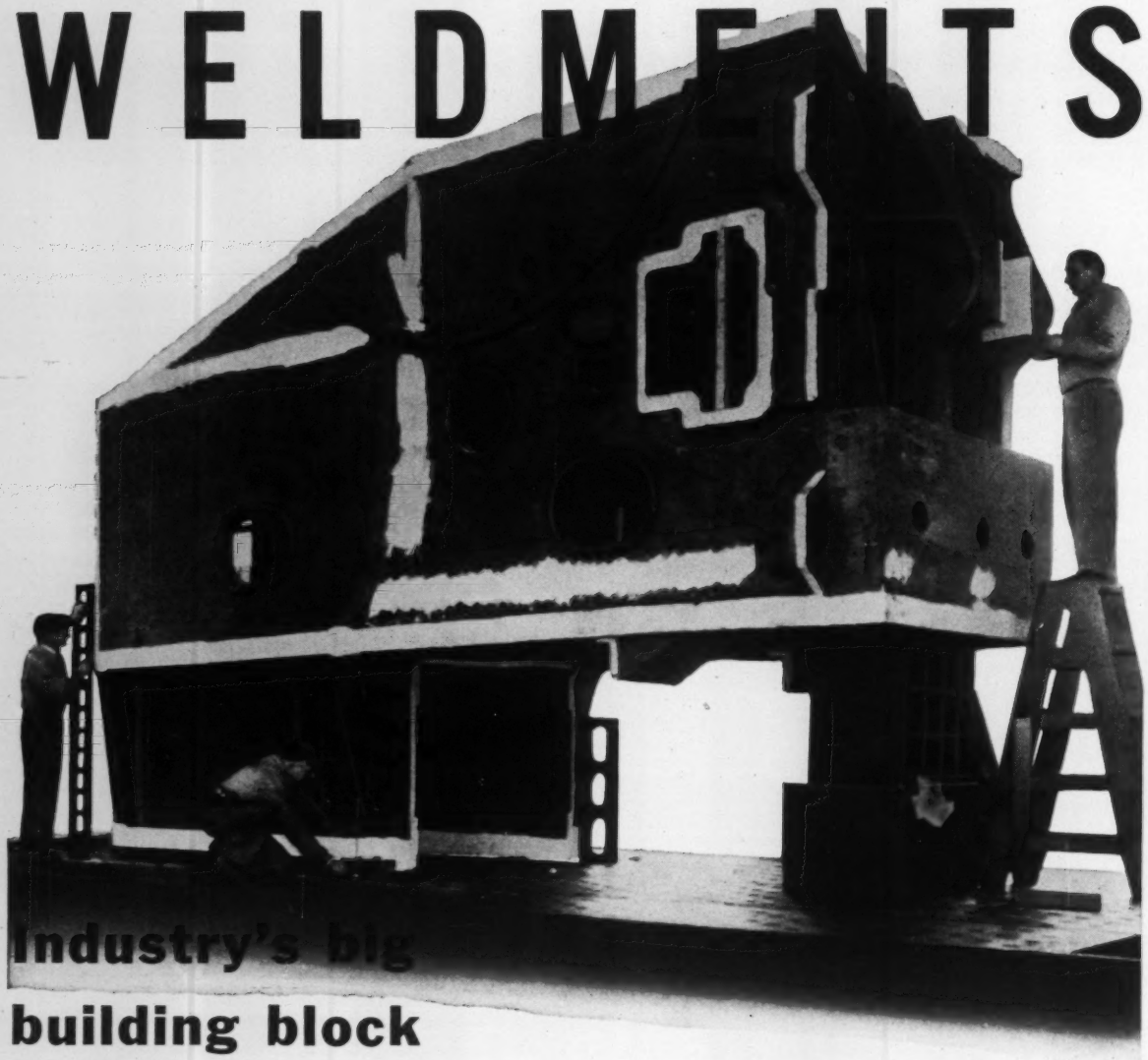
Jessop Steel Company
Washington, Pennsylvania

Plants and Service Centers:
Washington, Pa. • Los Angeles • Chicago • Detroit • Owensboro, Ky. • Wallaceburg, Ont.

JESSOP



WELDMENTS



industry's big building block

You're looking at a 55-ton weldment on a planer. It is typical of the machining—or building of a complete machine of any size—produced regularly in the Sun Ship machinery plant where marine and industrial equipment is built.

In our tank and steel fabricating shop, we build pressure vessels, fractionating towers, weldments, and heavy steel fabrications.

Our completely integrated shops concentrate facilities and skills for producing special machinery and components that meet the most critical standards.

When you need special machinery of any kind, you will want to discuss methods, equipment requirements and possible production layouts with Sun Ship's sales engineers.

Sun

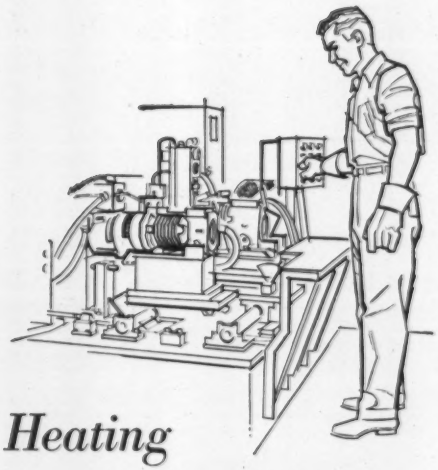
SHIPBUILDING & DRY DOCK COMPANY

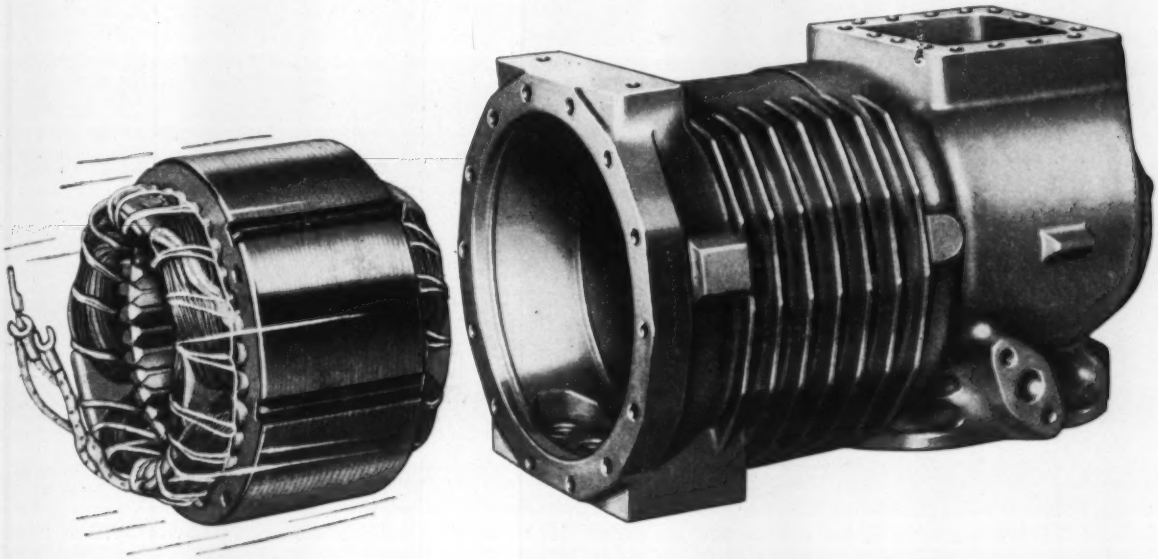
ON THE DELAWARE • SINCE 1916 • CHESTER, PA.

How a **Shrink-Fit** E-x-p-a-n-d-s Profits

Copeland Saves $100,000.00 A Year

with TOCCO* *Induction Heating*





Press-Fit Method

In the assembly of motor-compressors for their air conditioning and refrigeration products, Copeland Refrigeration Corporation formerly employed air presses for force-fitting their 1/5 HP through 1½ HP motor housings and stators. This method was costing Copeland $100,000.00 annually in labor, material and quality control expense to maintain the high quality of its product.

TOCCO Shrink-Fit Method

To reduce these costs, Copeland installed a 30 kw, 10,000 cycle TOCCO Induction Heating Unit. Motor housings are heated to 400° F. resulting in up to .013″ expansion. After cooling, the motor housing shrinks to form a predictable and perfect fit with the stator. Stator scoring and distortion are eliminated and $100,000.00 annual saving realized.

Whether your production problem is shrink-fitting or higher temperature applications such as brazing, heat-treating, forging or melting, look to TOCCO for an economical solution to any metal-heating problem.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today— **NEW FREE Bulletin**

The Ohio Crankshaft Co. • Dept. S-1, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Heating—Principles, Applications, Equipment."

Name_____

Position_____

Company_____

Address_____

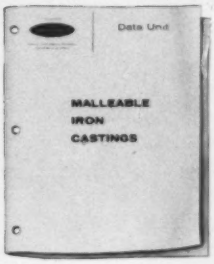
City_____ **Zone**____ **State**_____

New Cars and Trucks Use More Malleable For Better Performance...Lower Cost

As the automotive industry steps up its drive to pack greater performance into lighter weight vehicles and still hold costs in line, the demand for Malleable iron castings continues to increase. Noted for their strength, toughness, machinability and economy, Malleables are used as key components in every make and type of vehicle.

Matching each new advance in automotive technology, Malleable is now available in a broad range of properties, including tensile strengths from 50,000 to 120,000 psi!

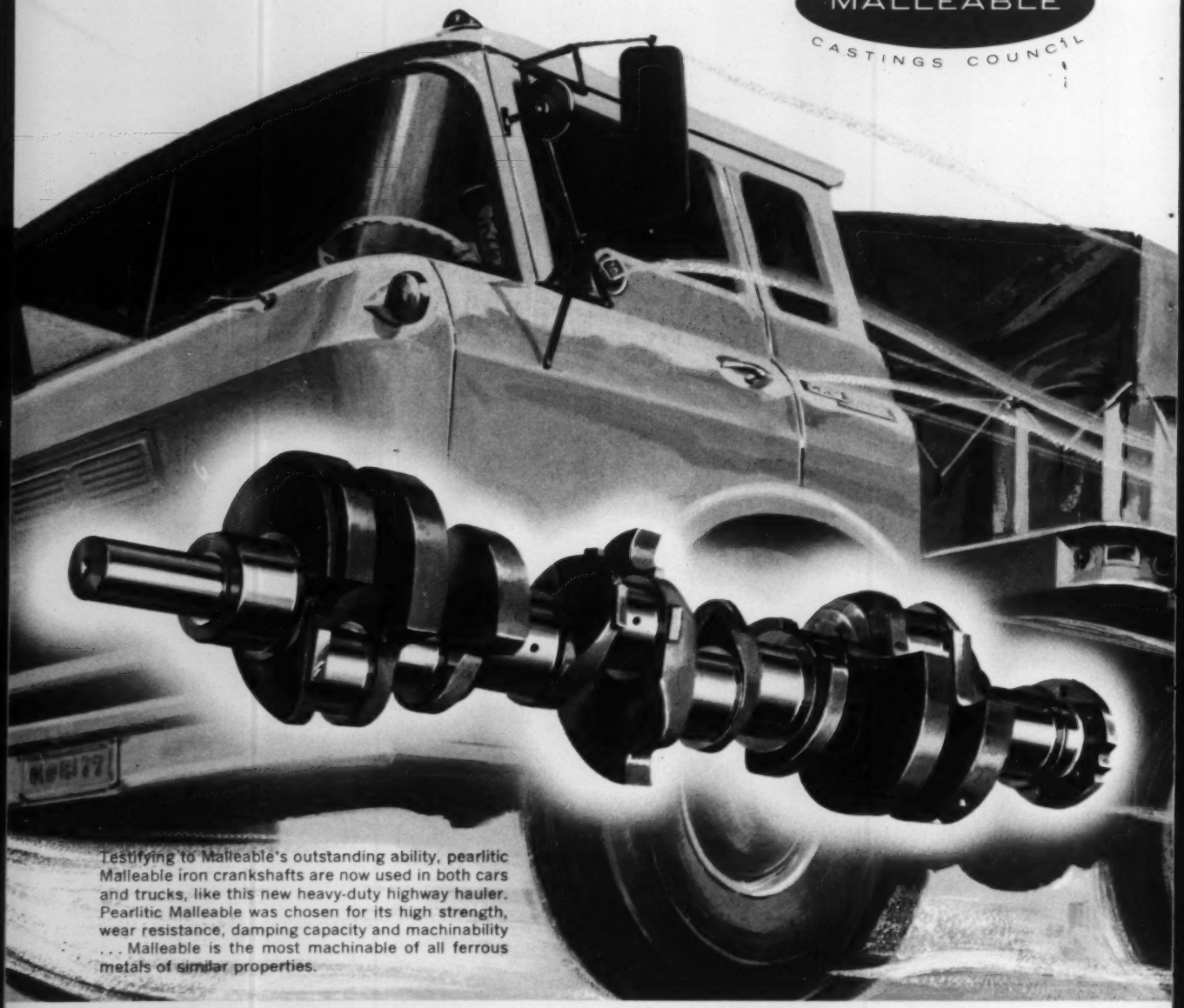
Find out now how much Malleable castings can improve your products. Contact any company that displays this symbol —



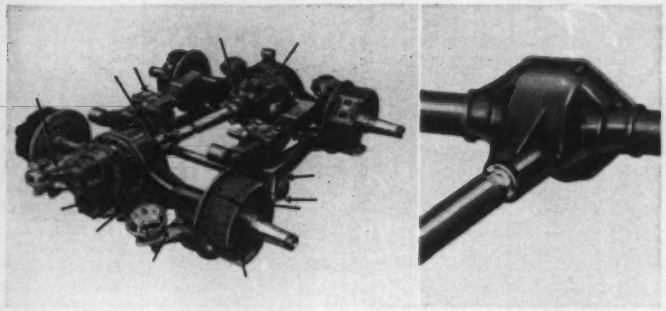
For Free Literature on advantages of Malleable iron castings, with examples from the automotive industry, ask any member company for Data Unit No. 113, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

MEMBER

MALLEABLE CASTINGS COUNCIL

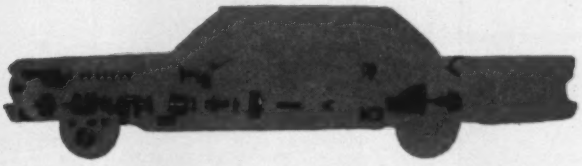


Testifying to Malleable's outstanding ability, pearlitic Malleable iron crankshafts are now used in both cars and trucks, like this new heavy-duty highway hauler. Pearlitic Malleable was chosen for its high strength, wear resistance, damping capacity and machinability . . . Malleable is the most machinable of all ferrous metals of similar properties.



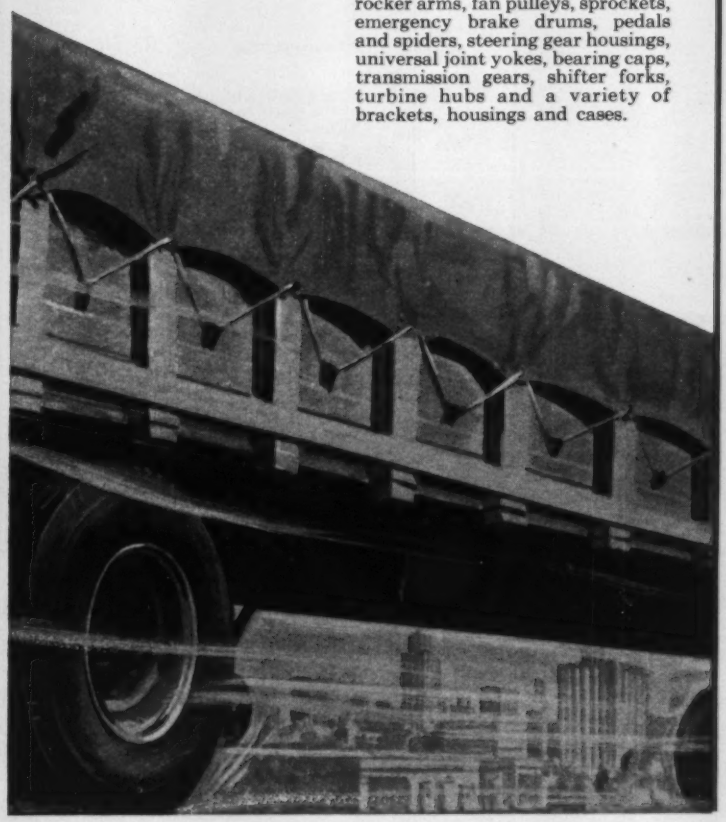
From the smallest cars to the largest trucks, all American vehicles rely on Malleable for a range of uses. In this tandem axle, for example, a total of 36 parts is Malleable.

Malleable differential carriers form the backbone of the rear axles on many new compact cars, as shown at the right above. Tubular steel extensions are pressed into the Malleable housing where they are "puddle" welded. Decisive factors in Malleable's selection were strength, economy, ease of machining and ability to be produced in a design that required a minimum of tooling expense.



The increasing conversion from other materials to Malleable castings for all kinds of parts from crankshafts to door hinges is adding momentum to the automotive industry's steadily increasing use of Malleable.

Among the many Malleable iron castings in this composite car are torsion bar arms and brackets, rocker arms, fan pulleys, sprockets, emergency brake drums, pedals and spiders, steering gear housings, universal joint yokes, bearing caps, transmission gears, shifter forks, turbine hubs and a variety of brackets, housings and cases.



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For Service Contact...

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Eastern Malleable Iron Co., Naugatuck

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
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Chicago Malleable Castings Co., Chicago 43
Moline Iron Works, Moline
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Albion Malleable Iron Company, Muncie Division, Muncie
Link-Belt Company, Indianapolis 6
National Mall. & Steel Castings Co., Indianapolis 22

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Iowa Malleable Iron Co., Fairfield

MASSACHUSETTS
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Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
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MINNESOTA
Northern Malleable Iron Co., St. Paul 6

MISSISSIPPI
Mississippi Malleable Iron Co., Meridian

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
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These companies are members of the Malleable Castings Council

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DESIGNERS AND BUILDERS
OF COMPLETE STEEL PLANTS

ROLLING MILLS FOR FERROUS and NON-FERROUS METALS

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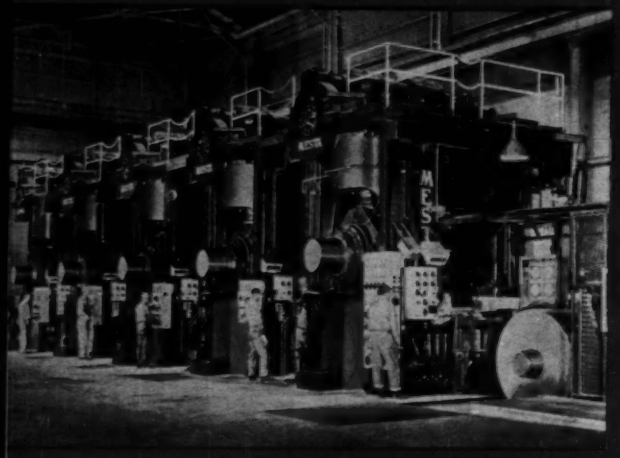
HEAVY DUTY MACHINE TOOLS

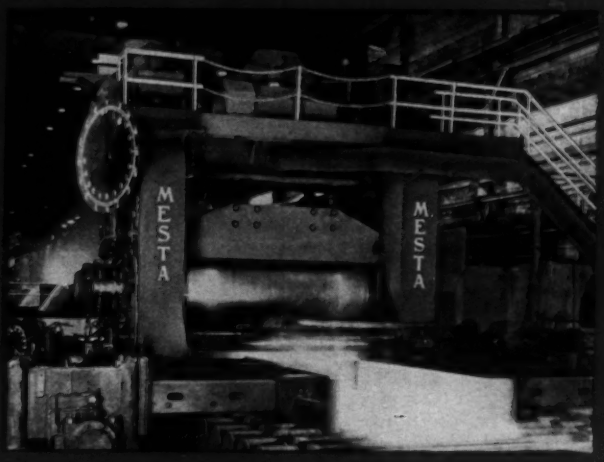
HYDRAULIC FORGING PRESSES

IRON and STEEL CASTINGS

GEARS • FORGINGS

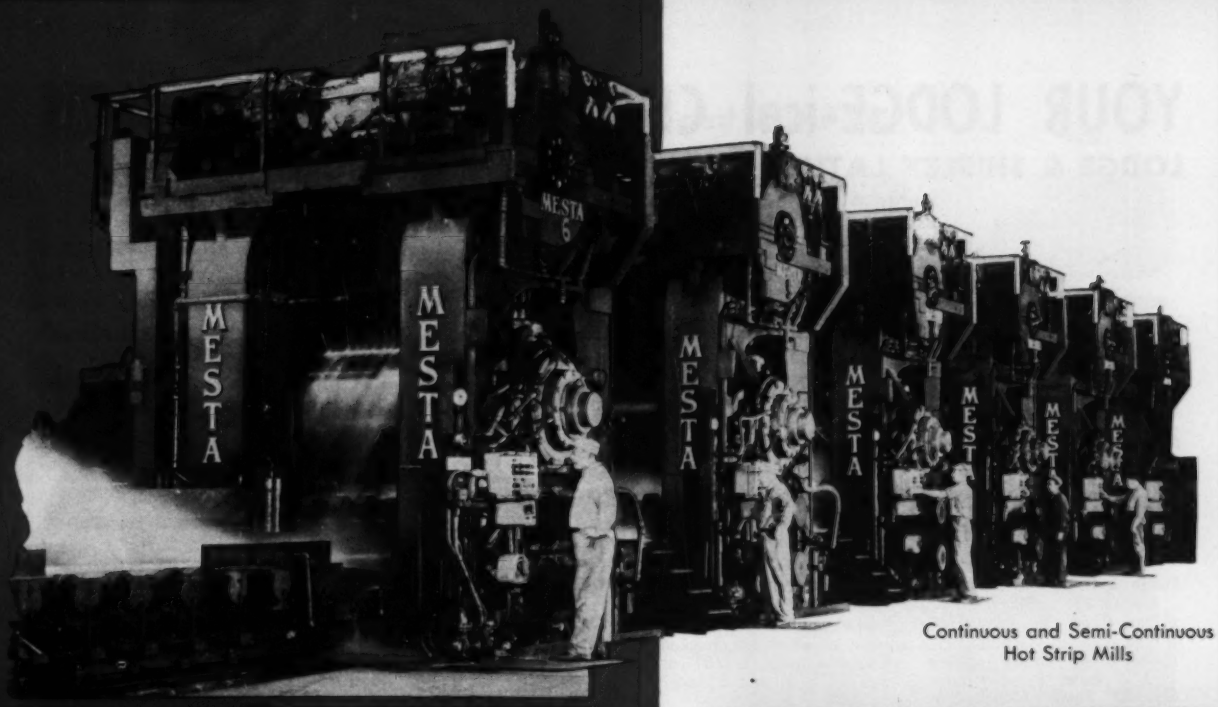


Four-High High-Speed Tandem Cold Mills

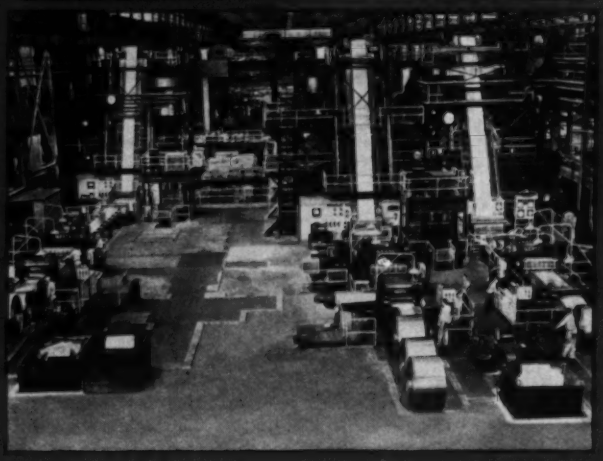


Four-High Reversing Plate Mills

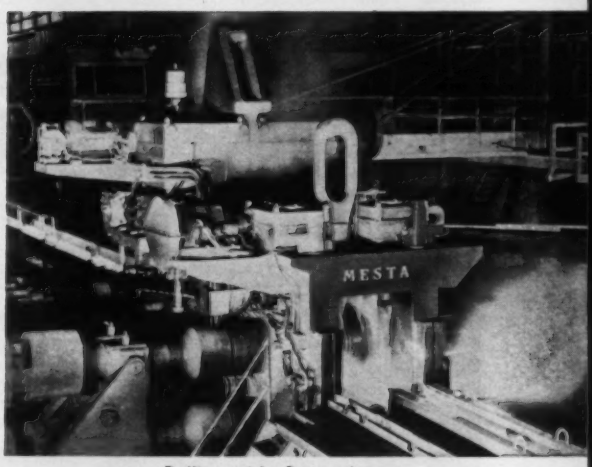
Rolling slabs and plates on Four-High Reversing and Vertical Edging Mills



Continuous and Semi-Continuous
Hot Strip Mills



Continuous Galvanizing Lines



Rolling wide flange beams on
MESTA Universal Structural Mills

MESTA MACHINE COMPANY

PITTSBURGH,

PENNSYLVANIA

Two-High Reversing
Slabbing-Blooming Mills

YOUR LODGE-ical CHOICE for PRODUCTION

LODGE & SHIPLEY LATHES

Lodge & Shipley CVA POWERTURN and HI-TURN Lathes offer the Canadian user exceptional advantages in performance and price, combining these important factors: modern American design, British-built at British prices and serviced locally throughout the Dominion.
Even more basically, these lathes give accuracy and rugged strength combined with greater precision and operating convenience.

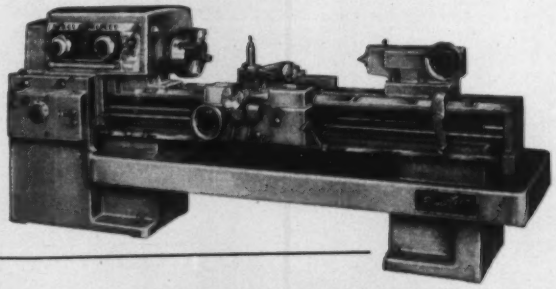
Select either fast, foolproof Speed Dial Headstock with but two dials for fast setting of speed change levers or POWER-SHIFT PRESELECTOR Lathes with single dial preselection of cutting speeds and fast, automatic remote shifting.

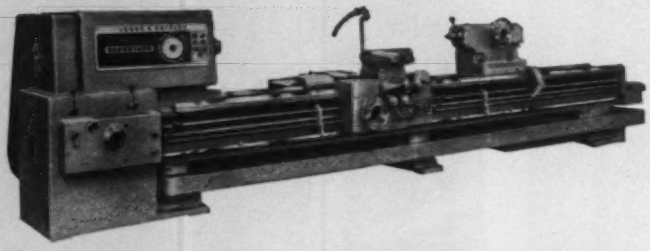
POWERTURN Lathes are produced in 1610 (13″ HD), 2013 (16″ HD) and 2013-17 (20″ STD) sizes in engine, toolmaker, gap, 45° and 90° tracer controlled types.

POWERTURN Lathes are also available in 2516 (20″ HD), 2516-27 (20″/30″ Raised), 3220 (25″ HD) and 3220-32 (25″/35″ Raised) sizes.

Lodge & Shipley offers a choice of tracer controlled lathes . . . with 45° or 90° tracing slide on all POWERTURN models. Lodge & Shipley POWERTURN Hollow Spindle Lathes are widely used for machining long workpieces which are chucked through the hollow spindle. Available with 8-7/8″ or 11-1/2″ holes in spindle in 2516 (25″ STD) and 2516-27 (20″/30″ Raised) Lathes.

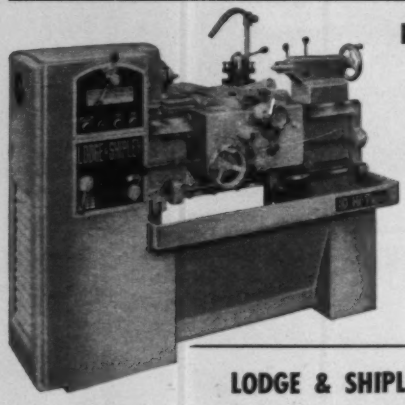
POWERTURN





LODGE & SHIPLEY SUPERTURN 2516 (28″) and 2516-21 (32½″) LATHE

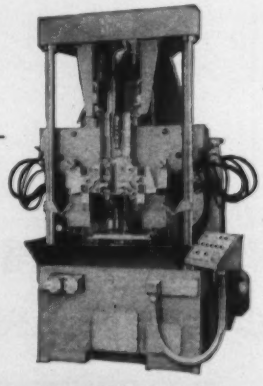
This lathe is extra big, extra powerful . . . designed for future turning needs with speeds from 8 to 1528 rpm, capacity to 60 hp. Powershift Preselect and 4-Way Power Rapid Traverse give ease and speed of handling equal to much smaller lathes.



LODGE & SHIPLEY 1307 HI-TURN (10″) LATHE

The Lodge & Shipley 1307 HI-TURN (10″) Lathe is completely new in size, design, utility and even in its low price. It provides high speed turning, boring and facing capacity where the use of a leadscrew is of no consequence.

The HI-TURN Lathe is extremely rugged and has nine geared speeds with a high spindle speed of 3000 rpm and 5 hp, giving the ability to handle newer, tougher metals at production rates. Also available with 45° hydraulic tracer slide and completely automatic cycling.



LODGE & SHIPLEY No. 12 VERTICAL FLOTURN

FLOTURN, originated by Lodge & Shipley, is a completely new precision metal forming production process without dies. Simple blanks are axially rolled into complex forms, saving time, material and tooling cost while adding to part strength and hardness. No. 12 Vertical FLOTURN allows completely automatic production; may be used with other metal forming processes for maximum speed and economy. Also available: No. 12 Horizontal, No. 24, No. 40 and No. 60 Horizontal models and custom-built larger machines for parts to 80″ in diameter. Sub-contract service also available.

COMPLETE LITERATURE AVAILABLE

. . . write for detailed literature on any of the Lodge & Shipley Lathes or for Condensed Catalog. Address: Nearest office, J. H. Ryder Machinery Co., Ltd., or The Lodge & Shipley Company, 3070 Colerain Avenue, Cincinnati 25, Ohio, U. S. A.

Lodge & Shipley

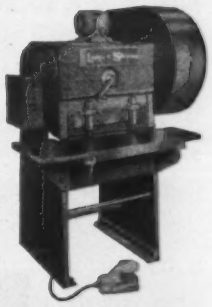
Lodge & Shipley SHEARS and BRAKES

for low-cost, dependable service

Lodge & Shipley equipment represents almost 100 years of experience in the design and manufacture of heavy metal working machinery . . . offers you the most advanced features for fast, accurate and versatile operation. Lodge & Shipley equipment is carefully engineered, ruggedly constructed and honestly rated to give trouble-free, low-cost production.

LODGE & SHIPLEY 24" SPEED SHEAR

. . . designed for accurate duplication of straight side parts without the expense of dies and punch press equipment. Production-proved for straight and angle shearing, slitting, notching, blanking and similar operations at speeds of 120 strokes per minute.
Capacity: 10 gauge x 24" mild steel.



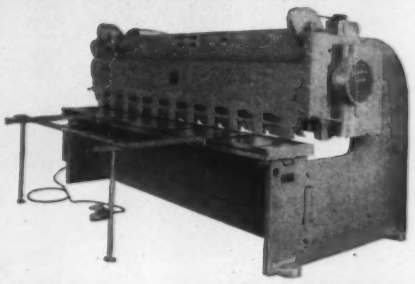
LODGE & SHIPLEY POWER SQUARING SHEARS...with the exclusive combination air clutch and brake

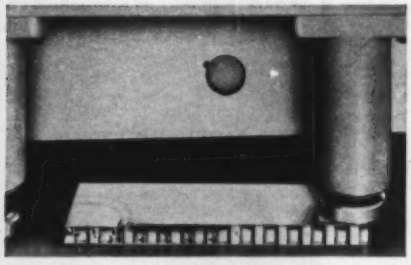
Eliminates unnecessary gear wear, gives never-failing overload protection, cushions shock.

Other important standard features include:

- Blade Clearance Indicator
- Front-Operated Back Gauge
- Positive Hydraulic Holddowns
- Quad-life Worm Gear Drive
- Super-Rigid Rolled Steel Plate Construction

Lodge & Shipley Power Squaring Shears are available in capacities from 10 gauge x 4 feet to 5/8" x 8 feet mild steel. Illustrated is 0410, 1/4" x 10 feet capacity.





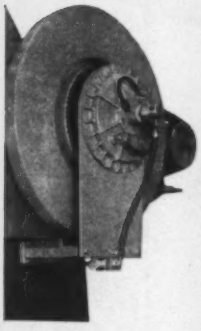
Sof-Loc HOLDDOWN SYSTEM

IMPACT ELIMINATED. . conventional hydraulic holddown damaged left corner of honeycomb sheet. Sof-Loc, with same holding pressure, but no impact . . . does no damage!

an optional exclusive feature on Lodge & Shipley Shears

Choose either standard Hydro-Hold or optional Sof-Loc Holddown . . . world's finest, most advanced holddown system . . . for unequalled holding power without impact, damage or clatter. Hydro-pneumatic action features fully adjustable holddown power and speed with "thinking valve" for safety.

LODGE & SHIPLEY POWER PRESS BRAKES...with specially designed combination air clutch and brake

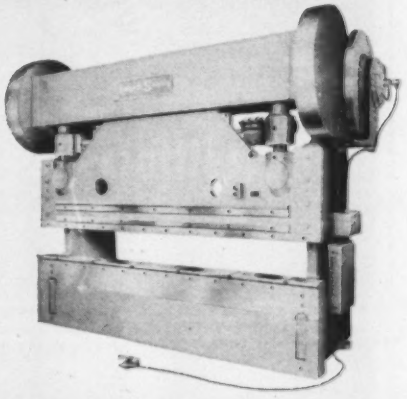


Requires no adjustment, installed in heavy, balanced flywheel . . . gives trouble-free service with minimum maintenance.

Other important features include:

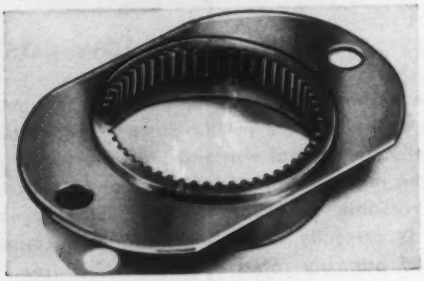
- Exclusive Wedge-Type Ram Pressure Release (optional)
- Motor-Operated Micrometer Ram Adjustment
- Exceptional Ram and Frame Rigidity

Lodge & Shipley Power Press Brakes available in capacities from 120 tons x 6 feet to 250 tons x 16 feet. Illustrated is 150 A 10; 12 feet x 1/4" max. mild steel capacity.

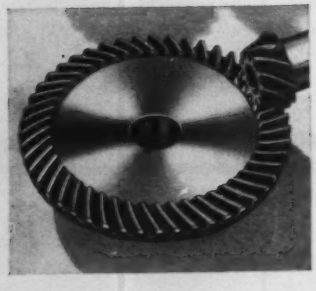


Write for new Shear and Brake Catalogs to J. H. Ryder Machinery Co., Ltd. (Offices throughout Canada) or . . . .

THE Lodge & Shipley COMPANY
3070 Colerain Avenue Cincinnati 25, Ohio, U. S. A.



if precision is your problem . .



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Being precise, almost to perfection, on a single piece or even two or three isn't much of a challenge to any competent shop. Being precise in terms of holding to really close tolerances on hundreds of thousands of pieces on a production run is something else again. Yet that's the kind of performance on which G.S. has built an unsurpassed reputation.

We set G.S. standards high to begin with: and we back them up with one of the finest plants of its kind in the country—with the most efficient machinery to be had—with first-class engineering in both design and production—with quality control systems and equipment which aim at perfection. Because every man in our plant knows that our standards brook no compromise, we've more than once had to reject only five or six finished Gears out of a production run of thousands.

If you value precision results on a production basis, in Worm Gearing, Bevels, Helicals, Ratchets, Zerols, Spirals, Clusters, Internals, Splines, Pinions or any other Gearing of special or standard design in sizes from 8 to 120 dp, from ⅛" to 8" diameter, G.S. belongs on *your* supplier team. Our engineers are at your service to discuss development of new projects, or better means to accomplish old ones.

Call or write us today!

.with production-quantity Small Gearing...your source should be...

YOU'LL FIND G.S. GEARING IN TOP QUALITY PRODUCTS LIKE THESE . . .

Adding Machines • Aircraft Carburetors & Fuel Metering Systems • Aircraft Instruments and Radios • Automatic Musical Instruments • Automation Systems • Business Machines • Check Signing & Protecting Machines • Clippers for Barbers, Animal Shearing & Hedge Trimming • Cloth Cutting Machines • Coin Changers & Counters • Communication Equipment • Control Mechanisms • Electric Fans • Electric Motors • Floor Polishers, Sanders, Scrubbers, Sweepers • Food & Drink Mixers, Blenders • Home Appliances • Lawn Sprinklers • Machine Tools • Meat Tenderizers, Grinders, Slicers • Military Equipment • Motion Picture Cameras & Projectors • Optical Instruments • Outboard Motors • Pneumatic Production Tools • Radio & Radar Tuning Assemblies • Radio Anti-backlash Gears • Range Finders • Record Changers • Sewing Machines • Steel Strap Stretchers • Step Switches • Tapping, Drilling & Threading Equipment • Telephone Dials • Television Sets • Thermostatic Controls • Typewriters • Vending Machines • Washing Machines.

•

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GEAR Specialties, Inc.

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SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARING

45 Years of Specializing in Small Gearing!

(ACTION MEMO)
Joe
Look at these...
formed from WIRE!
on National Cold Formers
and Headers (like bolts
and nuts)
Fast, fully automatic
and practically scrapless
production!
Let's take our longest-run
jobs to Tiffin and learn
what their latest design
machines and methods can do
for us! OK? Bill
Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING
MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS
BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS
CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING
PRODUCTION METHODS
HARTFORD DETROIT CHICAGO
NATIONAL MACHINERY CO.
TIFFIN, OHIO, U. S. A.

stainless steel

No other metal has the strength, beauty and versatile qualities that serve you so well today and promise so much for tomorrow.

There is nothing like stainless steel for HOMES AND HOME PRODUCTS

McLouth Steel Corporation,
Detroit 17, Michigan

Manufacturers of high quality Stainless and Carbon Steels

Look for the **STEELMARK** on the products you buy.

Stainless Steel

McLOUTH STAINLESS STEEL

CHEMICAL USERS' GUIDE

To General Chemical Products for the Metal Industries

Product	Available Forms	Commercial Strengths	Shipping Containers	Applications
Sulfuric Acid H_2SO_4 + Water	Liquid	66° Be (93.2% H_2SO_4)	Carboys Drums Tank Trucks Tank Cars	Pickling and descaling; electroplating; bright dipping; electrolytic polishing; galvanizing; anodizing.
Hydrochloric Acid HCl + Water *(Muriatic Acid)*	Liquid	18°, 20°, 22° Be (27.4% to 34.1% HCl)	Carboys Tank Trucks Tank Cars	Pickling; electroplating; bright dipping; galvanizing; tinning; etching metals; dissolving metals.
Nitric Acid HNO_3 + Water	Liquid	42° Be (67.2% HNO_3)	Carboys Drums Tank Cars Tank Trucks	Pickling; electroplating; bright dipping; oxide finishing; dissolving and stripping metals.
Hydrofluoric Acid HF + Water	Liquid	70% HF	Drums Tank Cars	Pickling; electroplating; electrolytic polishing; bright dipping.
Sodium Fluoride NaF	White Powder	98% NaF	Bags Fibre Drums	Manufacture of rimmed steel; heat treating; galvanizing; pickling; electroplating.
Sodium Bifluoride $NaHF_2$	White Powder	98% $NaHF_2$	Fibre Drums	Electroplating.
Sodium Silicofluoride Na_2SiF_6 *(Sodium Fluosilicate)*	White Powder	98% Na_2SiF_6	Bags Fibre Drums	Electroplating.
Trisodium Phosphate $Na_3PO_4 \cdot 12H_2O$ *(TSP)*	Crystal	18.4% P_2O_5	Bags Fibre Drums	Alkali cleaning.
Sodium Metasilicate, Crystal $Na_2SiO_3 \cdot 5H_2O$	White Granules Powder	29.2% Na_2O	Bags Fibre Drums	Alkali cleaning.
Sodium Metasilicate, Anhyd. Na_2SiO_3	White Granules Powder	50.5% Na_2O	Bags Fibre Drums	Alkali cleaning.
Oxalic Acid $C_2H_2O_4 \cdot 2H_2O$	Colorless Crystals	99.5% $C_2H_2O_4 \cdot 2H_2O$	Bags Fibre Drums	Oxide finishing; metal cleaning.
Potassium Fluoborate KBF_4	White Powder	98.5% KBF_4	Fibre Drums	Aluminum and magnesium casting; as a flux and grain refiner for aluminum; for removing magnesium from secondary aluminum alloys.
Sodium Fluoborate $NaBF_4$	White Powder	95.0% $NaBF_4$	Fibre Drums	
Ammonium Fluoborate NH_4BF_4	White Powder	97.0% NH_4BF_4	Fibre Drums	Aluminum and magnesium casting; electroplating.
Fluoboric Acid HBF_4 + Water	Liquid	48.0% HBF_4	Carboys	Electroplating; metal cleaning or dipping.
Lead Fluoborate $Pb(BF_4)_2$ + Water	Liquid	50.0% $Pb(BF_4)_2$	Carboys	Electroplating.
Nickel Fluoborate $Ni(BF_4)_2$ + Water	Liquid	44.0% $Ni(BF_4)_2$	Carboys	Electroplating.
Tin Fluoborate $Sn(BF_4)_2$ + Water	Liquid	47.0% $Sn(BF_4)_2$	Carboys	Electroplating.
Zinc Fluoborate $Zn(BF_4)_2$ + Water	Liquid	40.0% $Zn(BF_4)_2$	Carboys	Electroplating; bonderizing aluminum.
Copper Fluoborate $Cu(BF_4)_2$ + Water	Liquid	45.0% $Cu(BF_4)_2$	Carboys	Electroplating.

The products advertised are commercial chemicals having various uses, some of which may be covered by patents, and the user must accept full responsibility for compliance therewith.

Basic to America's Progress

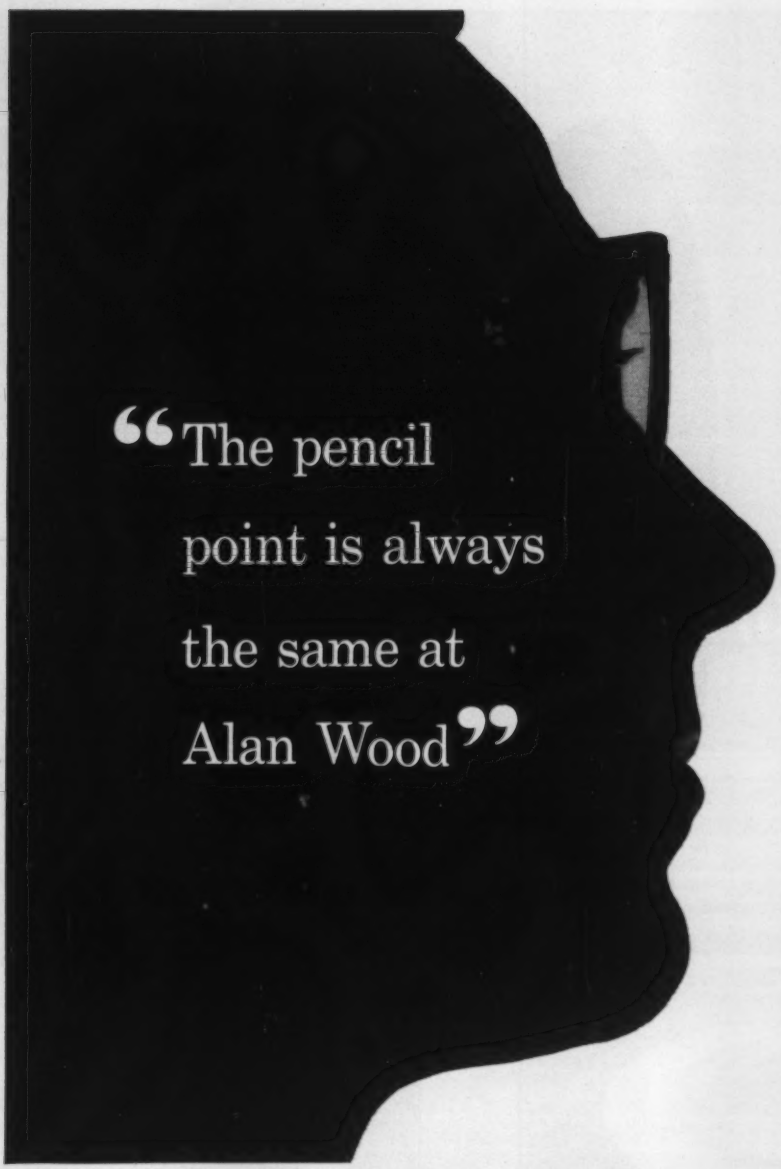
Allied Chemical

OTHER PRODUCTS: Acetic Acid; Ammonium Thiosulfate Solution; Aqua Ammonia; Barium Fluoride; Chromium Fluoride; Copper Fluoride; Copper Sulfate; Sodium Sulfate (Anhydrous); Iron Sulfide; Nickel Fluoride; Perchloric Acid; Sodium Bisulfite, Anhy.; Sodium Silicate; Sodium Sulfite, Anhyd.; Stannous Chloride; Sulfur; Tetrasodium Pyrophosphate; Sodium Tripolyphosphate; Potassium Titanium Fluoride.

FOR THE LABORATORY OR SPECIAL APPLICATIONS: BAKER & ADAMSON® REAGENTS and FINE CHEMICALS

GENERAL CHEMICAL DIVISION

40 Rector Street, New York 6, N. Y.



"Doing business with Alan Wood, we never have to worry about variations in pricing policy. Whether steel is short or plentiful, the pencil point is always the same."

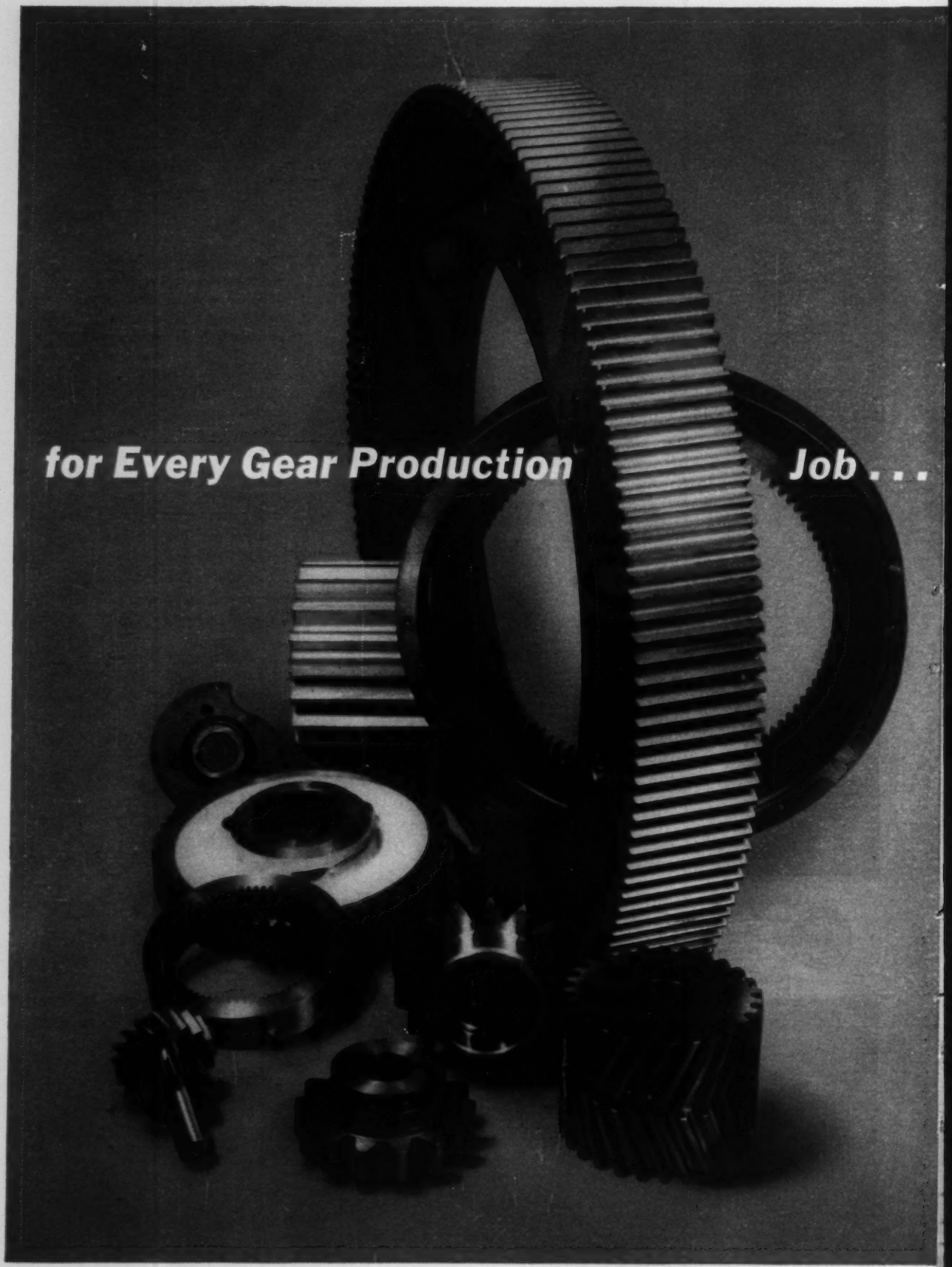
That's the way one Alan Wood customer said it, and we appreciate the acknowledgement. We do believe in consistent pricing policy. Moreover, Alan Wood is geared to give your order prompt attention without red tape delays. Your quality goes up, your costs and rejects go down, when you use dependable Alan Wood plate, sheet and strip.

When your metallurgical requirements need speedy, reliable analysis, ask for an Alan Wood study. Your Alan Wood representative is always available, ready to help.

ALAN WOOD STEEL COMPANY

Conshohocken, Pa. • **STEEL PRODUCERS WITH THE CUSTOMER IN MIND**

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle Montreal, Toronto and Vancouver, Canada: A. C. Leslie & Co., Limited

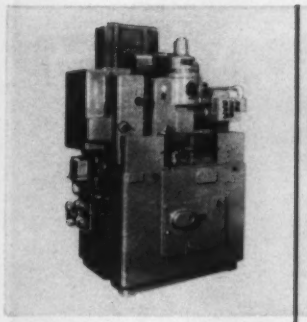

for Every Gear Production Job . . .

Right from the blank to the finished external or internal spur or helical gear, Fellows has the complete line of gear production and inspection equipment to meet all your requirements!

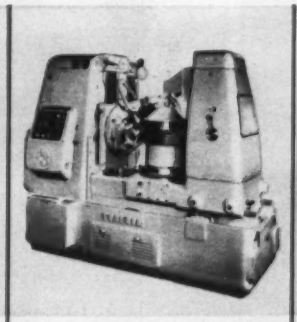
No other builder in the world offers as long and varied a line: Fellows Gear Shapers; Pfauter Gear Hobbers; Fellows-Reishauer Gear Grinding Machines; Fellows Gear Inspection Instruments; Fellows special machines and attachments; Fellows Gear Shaper Cutters. All this, *plus* the benefit of our sixty years of specialized experience in solving gear production problems.

Ask your Fellows representative for information on the complete line of Fellows gear production and inspection equipment. If you have a problem requiring special equipment, ask him to help you solve it, or write direct.

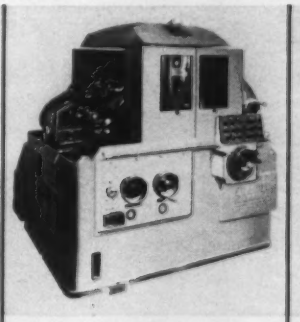
. . . Fellows Has the Equipment to Shape, Hob, Grind and Inspect



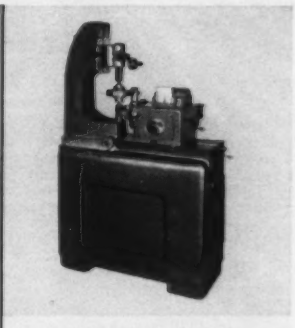
Fellows Gear Shapers cut internal and external spurs and helicals; capacities to 120″ P.D.



Pfauter Gear Hobbing Machines for spur and helical gears; capacities to 120″ P.D.



No. 12 Fellows-Reishauer Gear Grinding Machines grind spurs and helicals to 12″ O.D.



No. 20M Fellows Red Liners make and record the "composite check" of spur and helical gears to 18″ P.D.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont

Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
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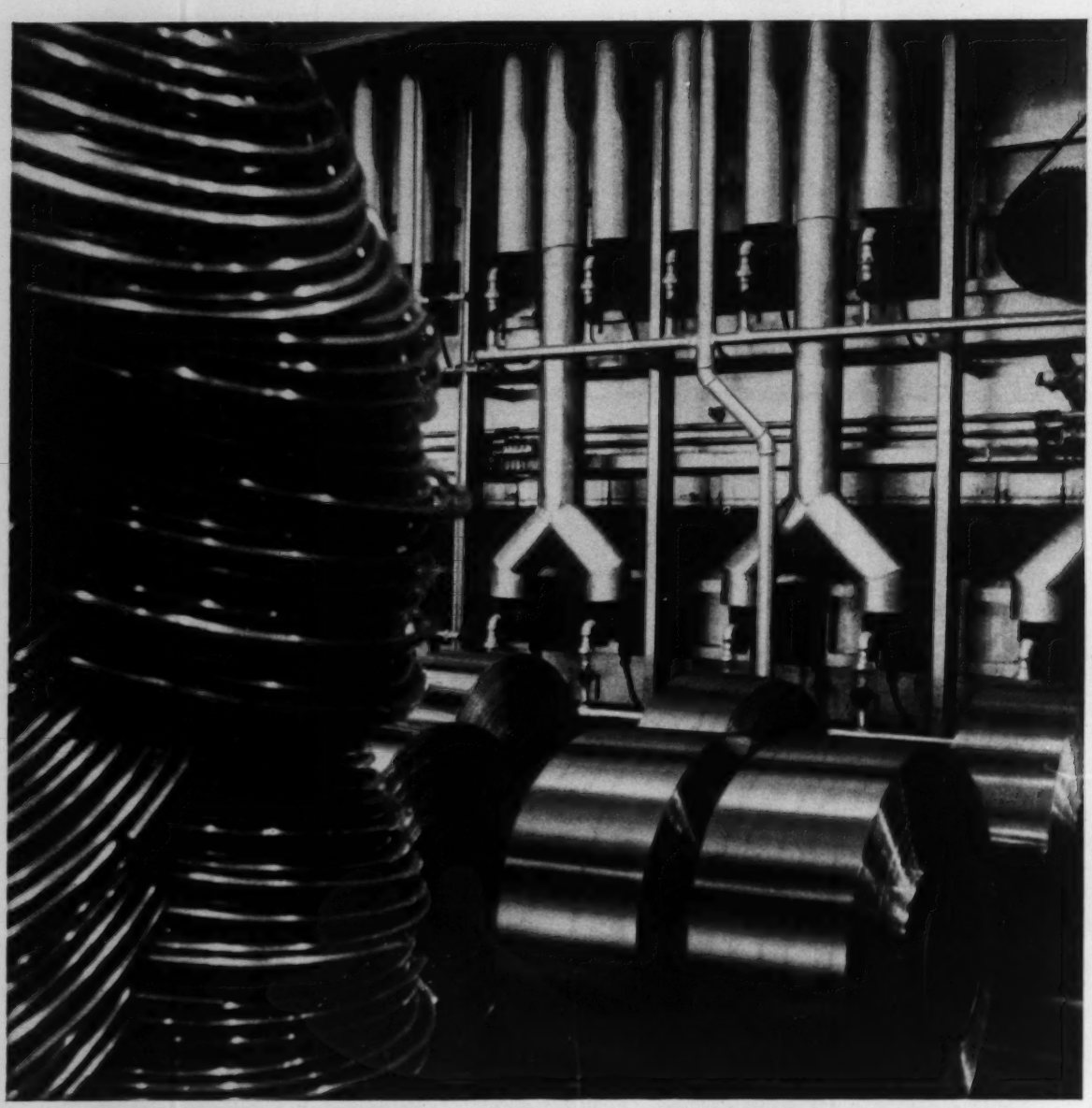
THE PRECISION LINE *Fellows* *Gear Production Equipment*



American Brass relies on GAS for precise control in heat processing

Five huge gas-fired furnaces handle heat processing at the new American Brass Company plant near Los Angeles—largest copper and brass mill in the West.

Gas heat anneals their copper and brass coils, tubing and strip . . . processes copper billets for extrusion and for piercing . . . and bright-finish anneals copper coils and tubing.

Why the choice of gas heat? Precise temperature control! Gas heat develops the required temperatures rapidly. Maintains them precisely. Adapts most easily to automatic temperature control. Offers unbeatable fuel economy.

Multi-purpose, gas-fired, radiant tube, forced circulation roller hearth furnace at American Brass Company's new Los Angeles mill. Used in the bright finish annealing of copper coils, tubing and strip.

American Brass, and thousands of other companies, can tell you *gas* is technically right and economically sound for all types of heat processing. Call the Industrial Sales Engineer at your local gas company. *American Gas Association.*

FOR HEAT PROCESSING GAS IS GOOD BUSINESS!

WHEREVER YOU ARE...

T & W SERVES YOU

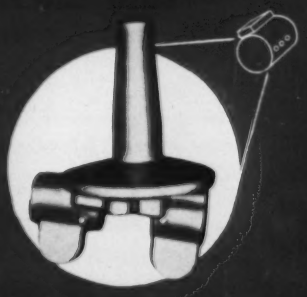
You do not have to be in any special area of the country, to obtain the benefit of T & W's wide range facilities. Our sales engineers are located in every major industrial region, because T & W's experience and facilities have such broad range that we serve all American industry. Wide range in plant facilities, in experience, in service, means that you get more from T & W.

SALES OFFICES: PHILADELPHIA • STAMFORD (OLD SAYBROOK, CONN.) CHICAGO • DETROIT • DALLAS • LOS ANGELES • SEATTLE

SPOTLIGHTING HOW T & W'S WIDE RANGE FACILITIES HELP INDUSTRY:

★

STEERING SPINDLE FORGING



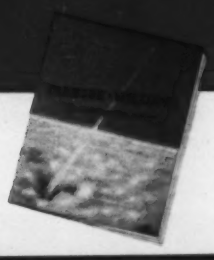
Inner core, vital in its function, this forging must be strong and reliable. Metallurgical laboratory, die designer, hammerman all contribute to the T & W Technique which makes it successful.

STAMPED GEAR COVER

A welded assembly of both stamping and forging for a design of maximum strength. Part is 11 gauge and measures 17½" wide, 12¼" high and is 1¼" deep.

WRITE FOR COMPLETE INFORMATION

To find out how you can benefit from T & W's help, write for the 20 page booklet "Transue & Williams Challenges the Future."



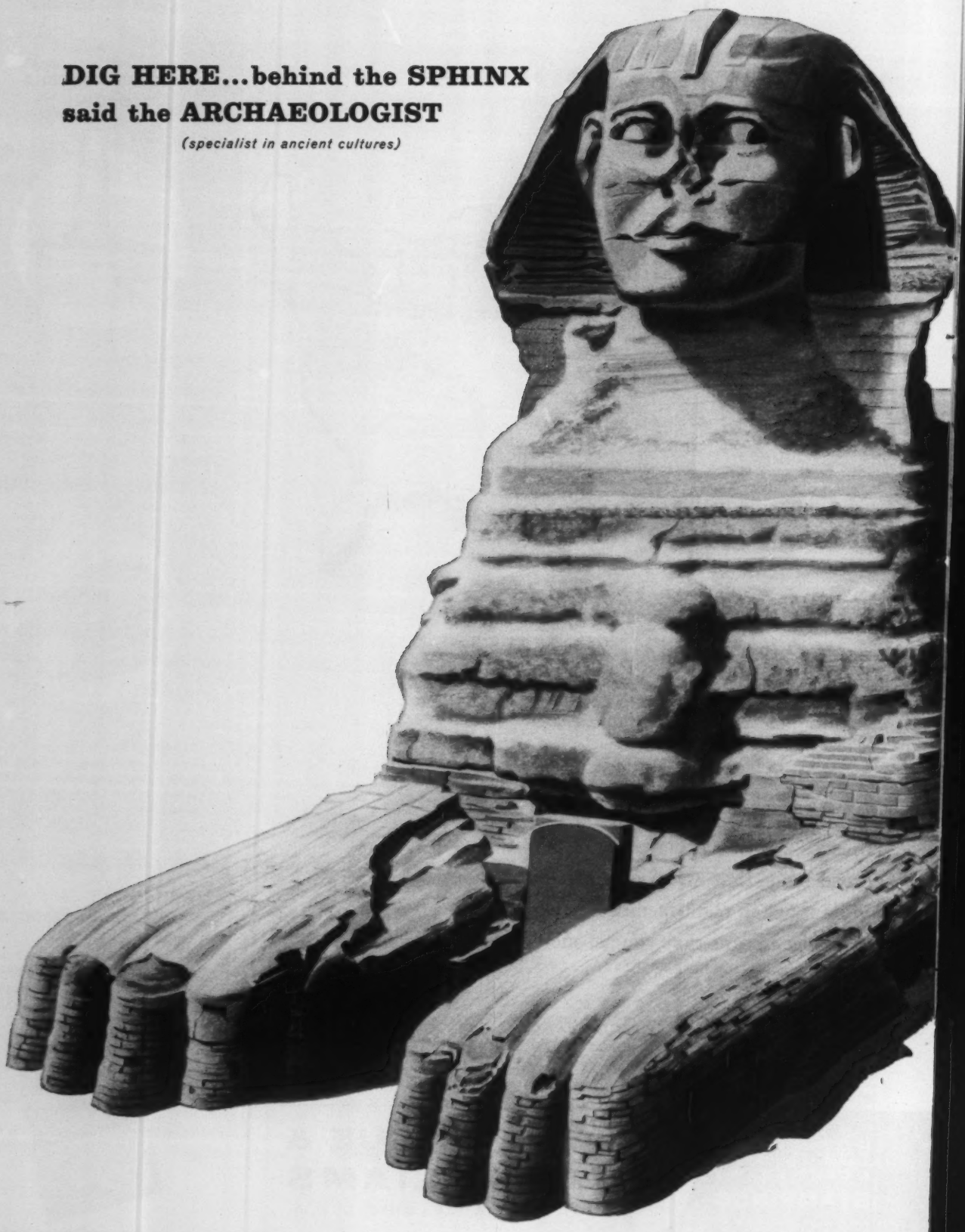
FORGINGS & DEEP DRAWN STAMPINGS

TRANSUE & WILLIAMS

ALLIANCE • OHIO, U. S. A.

DIG HERE...behind the SPHINX
said the ARCHAEOLOGIST

(specialist in ancient cultures)



Flip a switch...Weld AC or DC said the man from LINCOLN

(specialist in arc welding)

FROM the look on the Sphinx' face, we'd say the Archaeologist is about to hit pay dirt . . . and why not? Knowing where to dig is his specialty.

And, incidentally, knowing where to dig to solve welding production problems is a specialty of LINCOLN Field Engineers. And that pays off for his customers!

Take the typical problem which existed in a Pennsylvania plant producing engines and compressors. The LINCOLN Field Engineer was in the shop on an electrode application. He noticed that the operators were constantly moving from AC welders to DC welders . . . and then moving back again. This continual changing was required in order to use the proper electrode for each of the many types of jobs . . . varying from fabricated bases to pressure piping, and from short runs to production jobs.

The LINCOLN man recommended installing "IDEALARC TM" AC/DC welders which produce either AC or DC current. The operator has merely to flip a switch on the machine to change currents. The plant superintendent was skeptical, but authorized putting in two "IDEALARCS".

Results were gratifying. Immediately, management was able to schedule any type production to these machines. The operators could weld with AC—flip a switch—and in an instant be welding with DC. Both production and morale soared. Soon, five additional "IDEALARC TM's" were installed and the production problem was solved.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

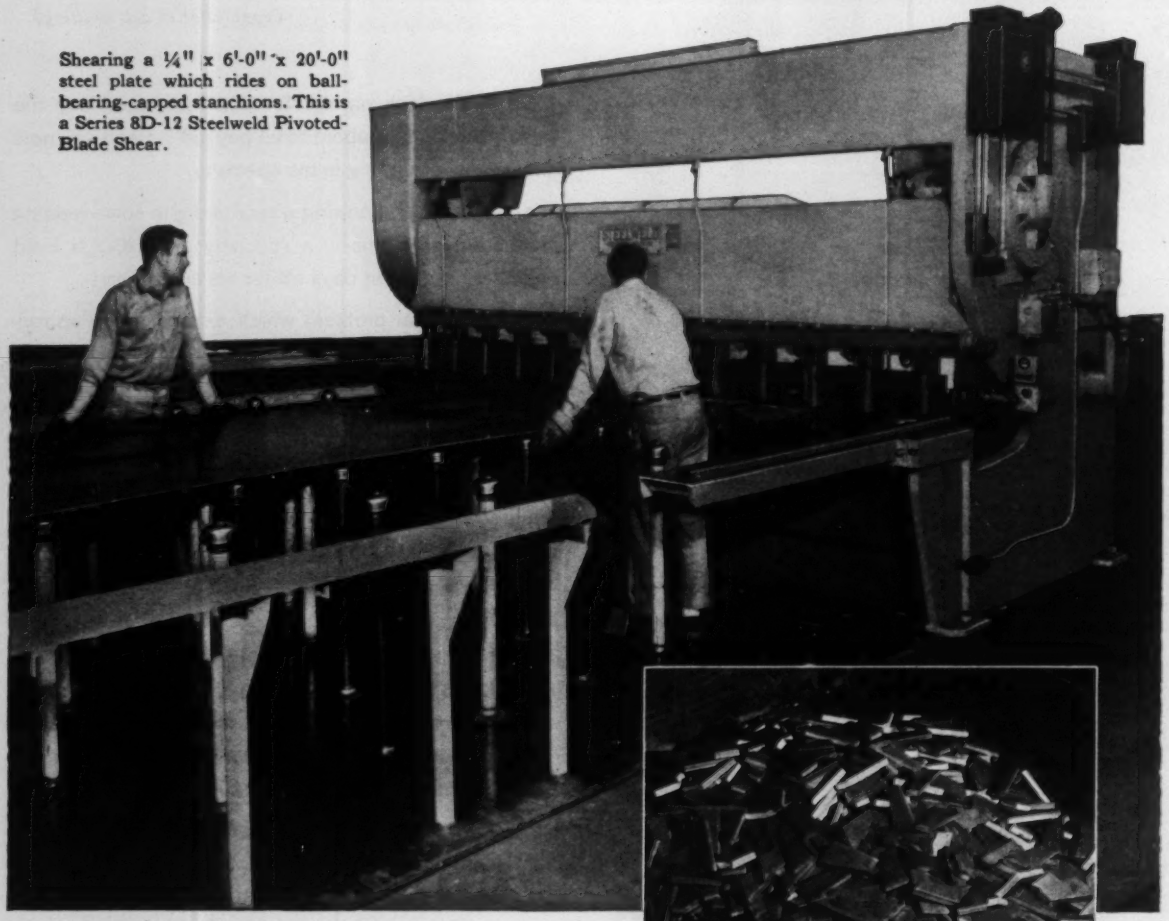
THE LINCOLN ELECTRIC COMPANY

Dept. 2911 • Cleveland 17, Ohio

LINCOLN WELDERS

STEELWELD SHEAR
Serves TOUGH JOBS Well

Shearing a ¼" x 6'-0" x 20'-0" steel plate which rides on ball-bearing-capped stanchions. This is a Series 8D-12 Steelweld Pivoted-Blade Shear.



A part of an order of 120,000 gussets cut on the shear.

FOR several years a Steelweld Shear has been in operation at the Drake Steel Supply Co., Los Angeles, California. Most of the time it has been worked on a 16-hour-a-day schedule. It is used for a wide variety of shearing, mostly on 3/16-inch and ½-inch steel plate.

The machine has proven itself on all sorts of shearing jobs. A particularly tough one was the cutting of 120,000 small odd-shaped gusset plates. These were of three sizes and cut three to six at a time of ½-inch steel. The work jarred the shear terrifically, but because of its heavy construction, did not affect it in any way.

Considering the volume of work and hard service, the knives hold up very well. They need be turned only about once every six months.

Write for free copy of catalog No. 2011

STEELWELD PIVOTED BLADE SHEARS

Steelweld Machinery includes: Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 7858 E. 282 ST. • WICKLIFFE, OHIO

KEYSTONE WIRE
for vital parts of BISSELL® Sweepers

Sweeper rotary brush is made with Keystone Brush Twisting Quality Wire.

Bissell Inc., world's largest manufacturer of carpet sweepers, with a global reputation for quality, specifies Keystone Wire for the vital parts of their Bissell Carpet Sweepers.

In this popular model, the axle rods are made of Keystone Silver Brite Galvanized Wire; the sturdy brush bristles are anchored in a solid wood roller with staples made from Liquor Finish Stapling Wire. Keystone high carbon Spring Wire is specified to absorb the flexing action of the wheels.

Walter Bradcoski, Senior Buyer, says, "Keystone Wire has always met our requirements exactly and is used in all our sweepers."

Keystone Wire Specialists have developed wire with correct thermal treatment, chemical analysis, surface and uniformity for Bissell Sweepers. These metallurgical engineers who know wire thoroughly, are always ready to offer you their experience to help you modernize your wire needs. They will recommend the wires best suited for your requirements. Call them soon...it could be a profitable contact!

Keystone Steel & Wire Company, Peoria, Illinois

KEYSTONE WIRE FOR INDUSTRY

MANUFACTURED AT PEORIA, ILLINOIS, U. S. A.

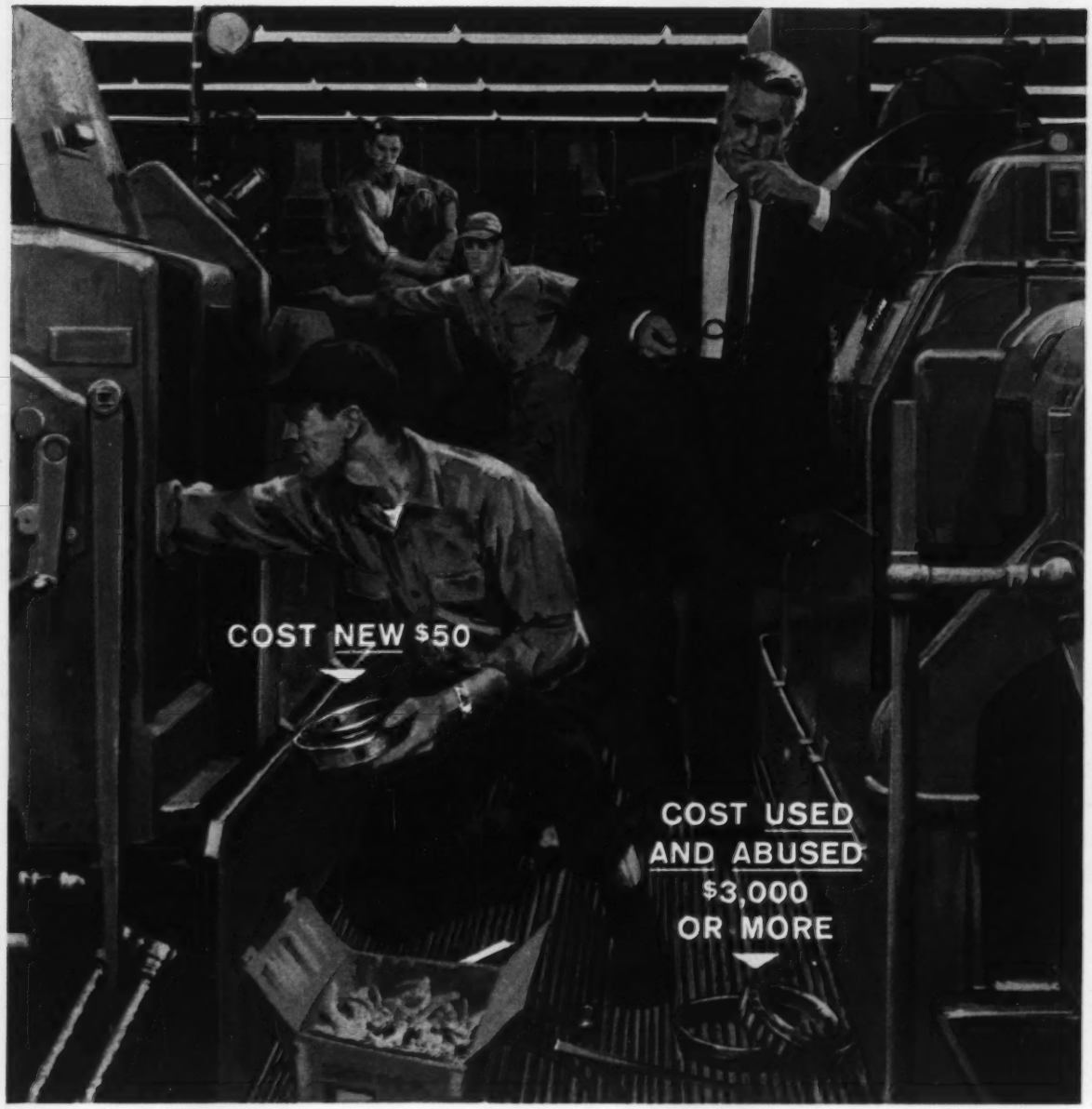
Here's data on the ideal pump for a wide range of industrial applications

Announcing NEW DE LAVAL IMO Pump Bulletin

New Bulletin 3200 contains all the data you need on De Laval IMO constant-displacement, rotary, screw type pumps. In its pages you will find (1) extensive application data including charts on fuel oil, SAE oil, and turbine oil viscosities; (2) selection information, including specific examples; (3) complete performance data on each IMO model as well as (4) dimension drawings and tables. Write today for your copy of this valuable, 40-page bulletin on the unique IMO pump.

DE LAVAL STEAM TURBINE COMPANY
860 NOTTINGHAM WAY, TRENTON 2, N. J.

DL-2300



That real cost figure tells him why lubrication is a management responsibility

When a bearing fails, a new one will cost, say, $50. But if that failed bearing shuts down your entire production line, the resulting downtime and lost production can run the bill up to $3,000 or more. And that's your *real* replacement cost.

Only management can effect a cure for this severe bite out of profits. Here's why:

A failed part is only a symptom; very often the *cause* is improper lubrication. The part can be replaced but the cause remains. The machine will fail again.

Like any plant-wide operation procedure, an organized lubrication system—which will prevent the vast majority of equipment failures—has to come from the top. For this reason, lubrication is a management responsibility.

For a preview of what Organized Lubrication can accomplish in your plant, we invite you to see our new movie "Stop Loss with Organized Lubrication." For an early showing, write:

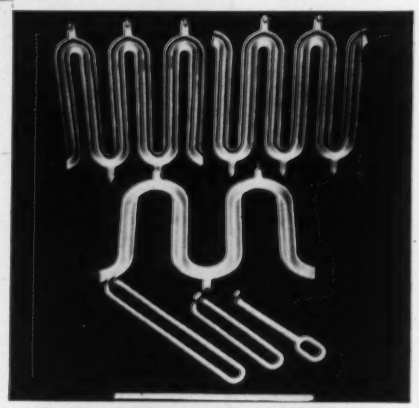
Texaco Inc., 135 East 42nd Street, New York, N. Y., Dept. S-170.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

Duraloy Tubes and Grids *to Meet Exacting* Specifications

THE ELECTRIC EF FURNACE CO.
GAS • OIL • ELECTRIC

Duraloy Centrifugally Cast Tubes 7'9" long, 7" O.D., ⅜" wall. 28 Cr 10 Ni; some of HOM alloy.



Duraloy Resistance Grids—Shell Molded. 18 Cr 38 Ni; some of special HOM alloy.

Heat treating furnaces need high alloy castings... radiant heat tubes for gas or oil fired... resistance grids for electrical... and castings for handling material through the furnace. *And the castings must be fail-proof!*

One reason—indeed the major reason—why The Electric Furnace Company, Salem, Ohio, has leaned so heavily on Duraloy for its castings is that over the years Duraloy Castings have established a fine record for durability and uniformity. And with the recent development of Duraloy HOM, the furnace company can work towards higher temperature operations. HOM can be used quite broadly at temperatures up to 2200°F and in a limited way to 2300°F. It can be cast statically, centrifugally and shell molded.

When such an authority on heat treating furnaces as Electric Furnace so consistently selects Duraloy castings for these furnaces on which it has built an enviable reputation... that preference suggests quite strongly that Duraloy castings are consistently sound and skillfully alloyed to meet exacting high temperature applications. This same skill offers comparable values to all who require high alloy castings.

Annealing furnace designed and constructed by The Electric Furnace Company used for cycle annealing of enameling iron strip and bright annealing of cold rolled strip. Three methods of heating: direct fuel fire; fuel fired radiant heat; and electric resistance used in the various zones.

The DURALOY Company

OFFICE AND PLANT: Scottdale, Pa.
EASTERN OFFICE: 12 East 41st Street, New York 17, N. Y.
CHICAGO OFFICE: 332 South Michigan Avenue
DETROIT OFFICE: 23906 Woodward Avenue, Pleasant Ridge, Mich.

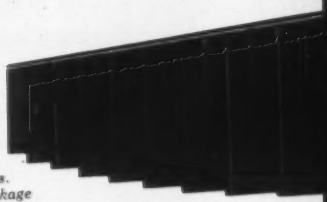
Photo Courtesy Electric Boat — a division of General Dynamics Corporation, Groton, Connecticut.

FOR EVERY APPLICATION, THERE'S ONE CRANE OUTSTANDING...

IN SHIPBUILDING . . . One of the many sensitive jobs in the construction of the "Ethan Allen," the U. S. Navy's newest nuclear powered missile submarine, is "setting the sail" — lowering the streamlined super-structure into position. It's a job that demands brute strength combined with razor-sharp precision control. A P&H overhead crane with P&H Electronic Stepless Magnetorque Control handles this assignment quickly, safely, and confidently.

As in every crane installation, P&H engineers have taken all factors affecting performance into consideration. The individual requirements, as well as the special problems, of this shipyard are integrated into the overall design. Result: performance that is never in doubt, dependability that users have counted on for over 76 years!

Job-engineering like this is the only proven way to keep your crane operating costs to a minimum — year after year, decade after decade. Why not find out more? Send for Bulletin C-68, Dept. 130, Harnischfeger Corporation, Milwaukee 46, Wisconsin.



Modern, all-welded construction eliminates excess bulk and weight in P&H's girder design. This means less wear, lower maintenance because there's less load on crane bridge wheels and support structures. In addition, cover-plate breakage is eliminated. Trolley-wheel loads are transmitted directly to web plates . . . no rivets to work loose.

P&H
OVERHEAD CRANES

HARNISCHFEGER
Milwaukee 46, Wisconsin

Photo courtesy Northwest Orient Airlines, St. Paul, Minnesota.

Part for part, one of today's turbo-prop or pure jet transports represents an investment that would have bought an entire fleet of planes a few years ago. Overhaul and maintenance procedures for these planes include extra-careful, jet-age methods for quick, safe, reliable handling of every airframe or power-plant part.

Northwest Orient Airlines' new maintenance center is equipped with P&H Balanced Design Hevi-Lift hoists in every department. These hoists provide the right combination of smooth lifting power plus precision spotting control to handle aircraft components with maximum care and minimum effort.

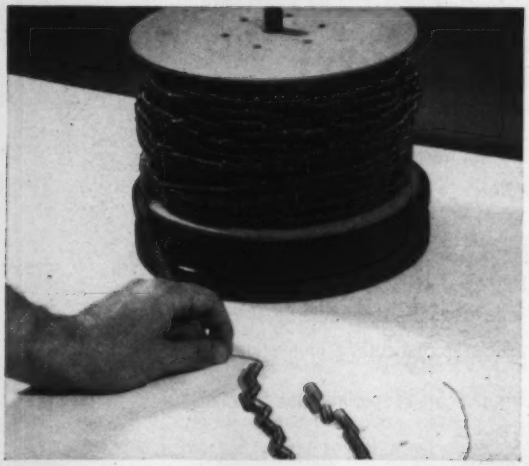
What's more, every P&H hoist in this most modern shop is equipped with the new P&H Pull-A-Hoist — a separate motor-driven tractor unit that provides smooth rolling power and precision positioning of each hoist at the touch of a button. No more lost time tugging or lugging of parts for Northwest's busy mechanics and maintenance specialists!

Bulletin H-63 gives you the complete data about the P&H Pull-A-Hoist — America's newest, most efficient hoist-tractor. Write Dept. 229, Harnischfeger Corp., Milwaukee 46, Wisconsin, today!

P&H
ELECTRIC HOISTS

HARNISCHFEGER
Milwaukee 46, Wisconsin

Reduce your assembled costs with new Spring-Flow® packaging



. . . more efficient handling, storing, sorting, orienting, feeding, placing of springs for installation

To production planners, Spring-Flow packaging opens up a world of possibilities for assembling A.S.C.-made springs, small stampings, and wire forms into your products easier and faster. It solves many problems caused by intricate shapes, tangling, loss by spoilage; maintains critical tolerances, uniform quality; simplifies inventory control and storage.

To learn how Spring-Flow may solve your problem, contact the nearest A.S.C. Division, or write for Spring-Flow booklet giving additional information.

6004

Associated Spring Corporation

General Offices: Bristol, Connecticut

Wallace Barnes Division, Bristol, Conn. and Syracuse, N. Y.
F. N. Manross and Sons Division, Bristol, Conn.
Dunbar Brothers Division, Bristol, Conn.
Wallace Barnes Steel Division, Bristol, Conn.
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Gibson Division, Mattoon, Ill.
Milwaukee Division, Milwaukee, Wis.
Seaboard Pacific Division, Gardena, Calif.

Canadian Subsidiary: Wallace Barnes Co., Ltd., Hamilton, Ont. and Montreal, Que. Puerto Rican Subsidiary: Associated Spring of Puerto Rico, Inc., Carolina, P.R.

QUALITY...TODAY'S DIFFERENCE BETWEEN PROFIT AND LOSS!

These are the days of the 12-month warranty . . . extended service guarantees! Never before has Quality been so important.

That's why we suggest you consider BarnesdriL Honing Machines for your surface finishing operations. Because of the quality inherent in these precision-made machines, they impart that "extra" touch of quality to your products at cost-cutting production speeds.

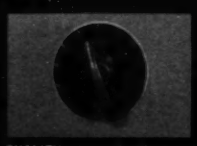
Our detailed story — backed by 35 years of specialization in honing — is yours free! Ask for catalog 200.

BARNESDRIL HONING MACHINES

Honing Machines/Production Units
Filtration Units/Drilling Machines

BARNES DRILL CO.

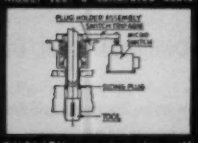
854 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE • 13121 PURITAN AVENUE



QUALITY is insured with correct hone feeds . . . made possible with this easy-to-set infinite hone feed control.

QUALITY at high-production rates means exact spindle speed rates . . . selected with a flick of the fingers.

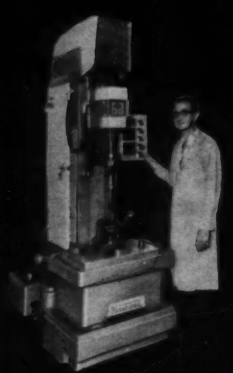
QUALITY results from correct reciprocation speeds . . . easily selected with this dial or, on the Model 122, a calibrated scale.

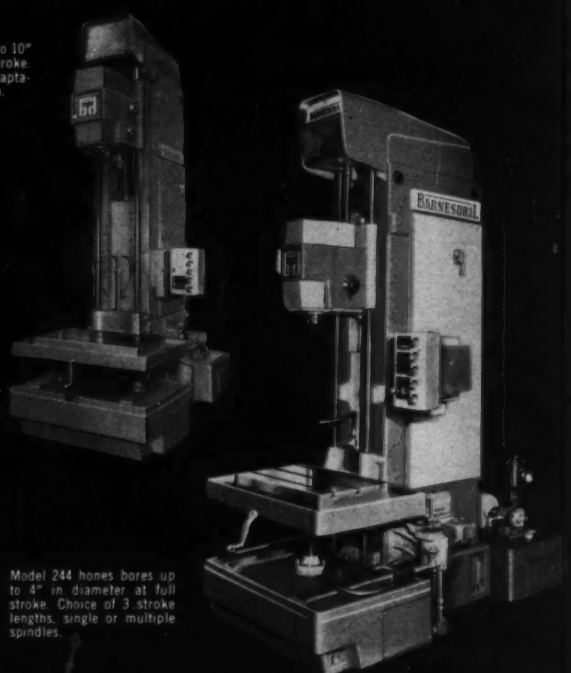


QUALITY is automatic with Plugmatic bore-to-bore sizing . . . production size consistency maintained to .0002".

Model 3010 hones up to 10" diameter at full stroke. Choice of 4 strokes. Adaptable for full automation.

Model 122 hones bores up to 2" in diameter at full stroke. Available in 1 or 2 spindles and a variety of fixtures and tables.





Model 244 hones bores up to 4" in diameter at full stroke. Choice of 3 stroke lengths, single or multiple spindles.

OUR FULLY EQUIPPED JOB HONING DEPARTMENT CAN HONE ANYTHING UP TO 25 FEET IN LENGTH. WRITE FOR DETAILS!

Turn Waste into Power

Metalworking is entering a year in which physical volume and dollar sales promise to be fair. Both could show a modest improvement over the 1960 pace.

But metalworking managers are gravely concerned about the profit squeeze. Net earnings have been skidding for several years. The dip this year may be sharper than usual.

The era in which cost increases can be passed along (and maybe something added) as price increases is gone. Price competition is severe. In some cases, it's ridiculous. Intense pressures from overseas and from domestic producers suggest that no relief is in sight.

The pinch calls for a much closer look at cost management.

Let's start at the top.

People are metalworking's biggest cost. This year, we will spend $58 billion for wages, salaries, and direct fringes. That's twelve times what we will spend for capital equipment.

How good are our people doing their jobs?

Measurement of human efficiency, except in the most standardized jobs, is a nebulous thing. But many students believe people efficiency drops to 30 or 40 per cent of what it should be.

Part of our inefficiency results from affluence that has been building up over the past two decades. We've become a little fat.

Part of it stems from our rapid growth and expansion. Both have permitted the establishment or continuation of unnecessary jobs, and the people in those jobs, quite naturally, have adjusted to the situation and perpetuated it.

Part is caused by featherbedding and the insistence by unions on work rules that promote wasteful practices.

Part can be blamed on Parkinson's law: The number of managers expands (by its own inner law of growth) without reference to the amount of work to be done.

A lot arises from inadequacies in planning, in job definitions, and in communications.

The opportunities for getting more for the dollars we spend on people are great. In the following pages, the editors of this magazine explore the problem, its causes, and suggest some possible remedies. We don't pretend to have all the answers, but we hope we have suggested some sensible approaches.

Let's tackle the high cost of human inefficiency with courage and wisdom, tempered with human understanding.

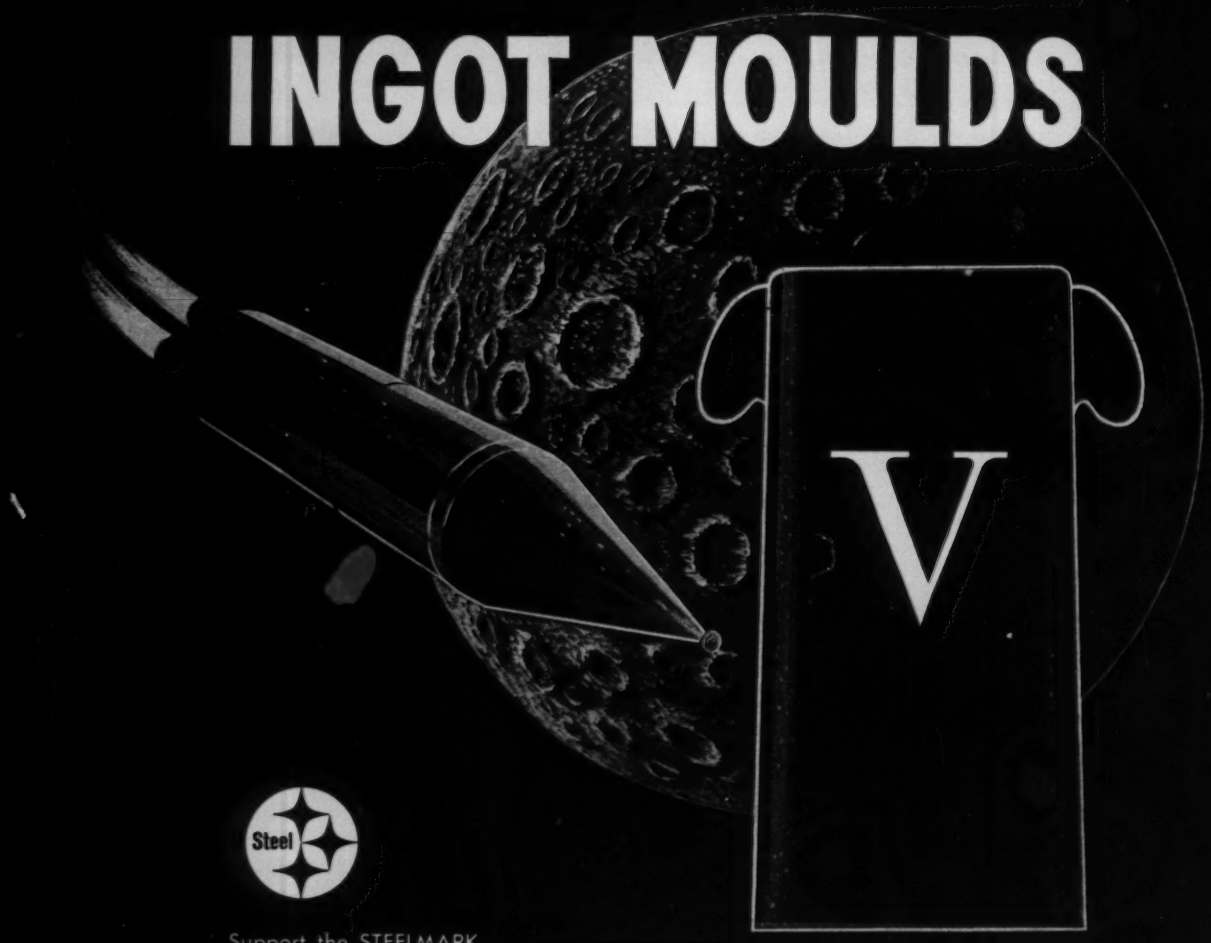
Let's turn waste into power.

Walter J. Campbell

EDITOR

For over 75 years steel has been poured into Valley Moulds, and now the new metals... used in space .... will also be poured into

VALLEY INGOT MOULDS



Steel

Support the STEELMARK

VALLEY MOULD AND IRON CORPORATION

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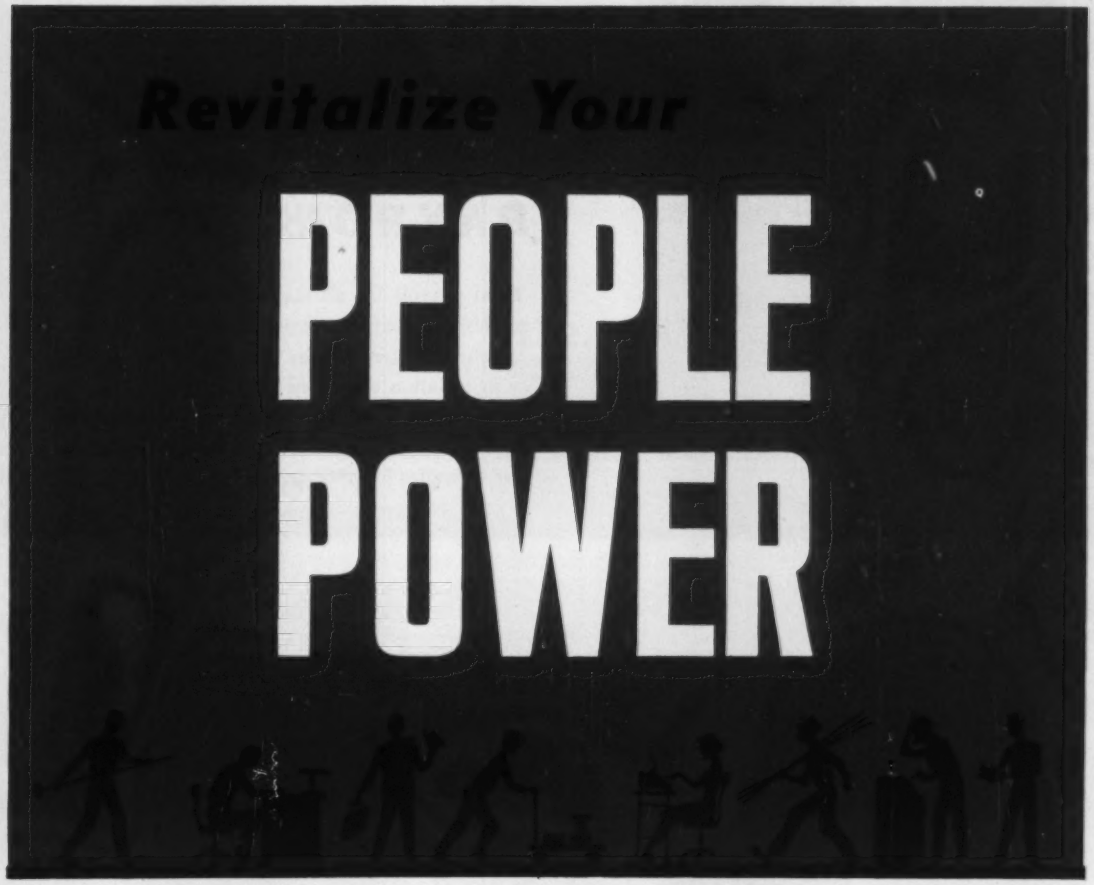


METALWORKING will spend $58 billion for compensating its people in 1961. How much of that staggering sum will go for coffee breaks, featherbedding, incentive rigging, long weekends?

The expenditure for people will be 12 times what we'll pay to get more efficiency with new capital equipment. Yet, for the $58 billion going in wages, salaries, and direct fringes we're getting an efficiency as low as 30 per cent (from some clerical people) and rarely more than 80 per cent (from some production workers).

If we don't use our human resources more effectively . . .

- Our disadvantage in foreign trade will worsen. (We already pay three to five times as much in wages as our major foreign competitors.)
- Our inflation will worsen. (In the 1950s, physical output per manhour in manufacturing grew at the average yearly rate of less than 3 per cent, while payrolls rose more than 6 per cent annually.)
- Our profits will worsen. (In 1950, profits were 9.4 per cent of national income; in 1959, they were 6.1 per cent.)

If in the 1960s we can boost our output per manhour to an average yearly 3.5 per cent (and we did better than that in the early 1920s, the late 1930s, and the late 1940s), economists predict these results by 1970:

- Stable prices and full employment.
- An average workweek of 35 hours.
- A 40 per cent gain in average annual income and our scale of living.

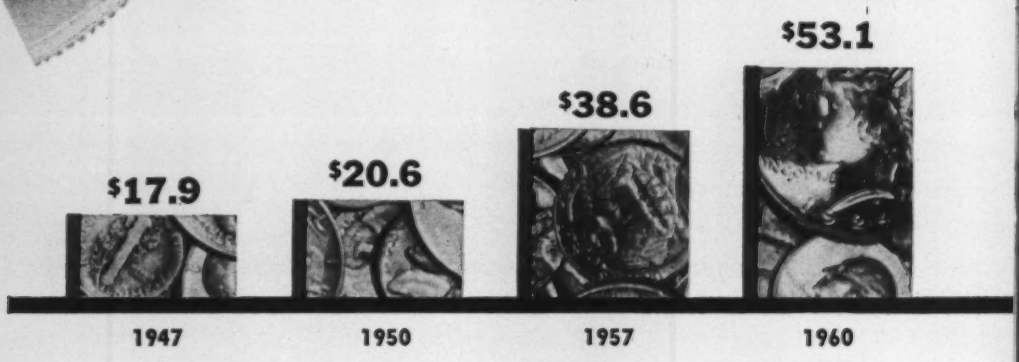
What Has Gone Wrong, And Why?

The fundamental reasons for our need to revitalize people power lie deeper than coffee breaks, long weekends, or early quittings. To get to the bottom of the problem, we must consider our affluence, our industrial complexity, and the rapid pace of our technology (Page 93).

In Europe and Japan, many people still don't have refrigerators, autos, or other material things that we in America regard as commonplace. And they're willing to work hard to get them. We don't have the lean and hungry look. We are in danger

METALWORKING'S PAYROLL SOARS

Total payroll for all metalworking employees includes all salaries, wages, and undeferred fringe benefits. Figures are in the dollars of each year, with inflation estimated for the future. The Census Bureau is the source for data through 1957. Eddy-Rucker-Nickels Co., Cambridge, Mass., made the estimates for 1960 and on.



of becoming victims of our own opulence.

Complexity takes its toll in a number of ways. From 1950 to 1960, the industry's employment jumped from 6.2 million to 7.8 million, total payrolls from $20.6 billion to $53.1 billion, and number of plants (20 or more employees) from 21,000 to 29,700. Climbing as dramatically were the employment and payrolls that are related to metalworking—in mining, transport, service, and other industries.

Such complexity has brought about shifts in the content of metalworking's work force. For every 100 employees in 1950, 18 were whitecollar (7 management, 11 nonsupervisory). By 1960, 28 were whitecollar (10 management, 18 nonsupervisory).

Plants are larger, too. In 1960, facilities with 100 or more employed were 46 per cent more numerous than they were in 1950. Plants with 20 to 99 employees gained only 38 per cent in number over the decade.

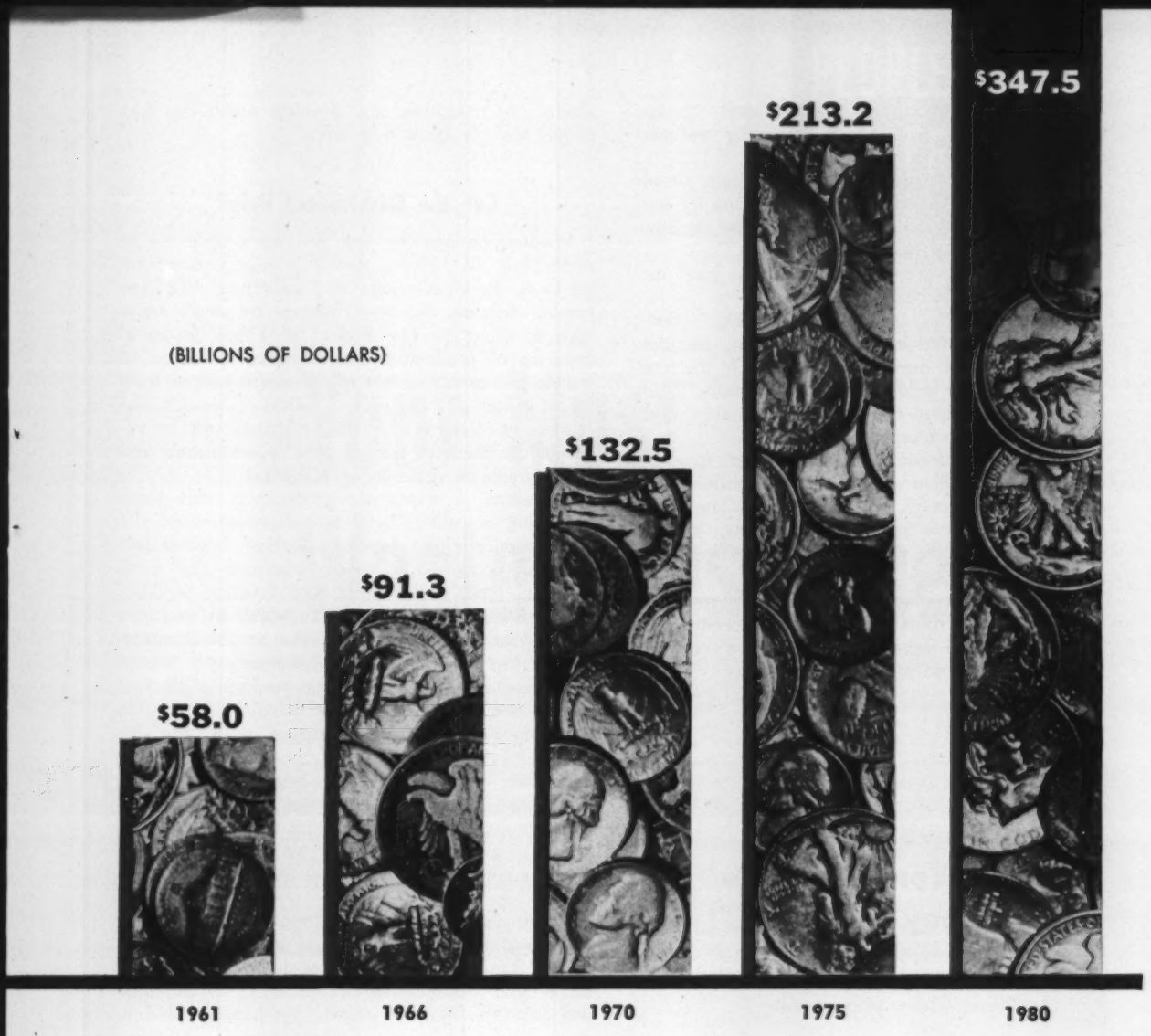
The changes have caused many problems. And many managers have not yet resolved them. The indecision has resulted in inefficiencies.

The rapid pace of our technology is pointed up by an analogy: We're like a pedestrian caught in the middle of a busy roadway between onrushing streams of traffic. Many metalworkers don't know which way to turn. The prime example is organized labor and its attitude toward automation. Some unions want to freeze or at least make slush of the advance.

Labor isn't the only group disturbed by our headlong speed. The president of an electronics company says: "Nine executives of ten who are 50 or older and in a technically based firm don't fully understand the technical problems with which their company is concerned because we have advanced so far since their college days."

Republic Steel Corp. offers technical background courses to its older personnel so they can keep up with developments.

The three chief barriers to better use of our human resources lead to many results which, themselves, add to the problem. Among them are complacency, bureaucracy, poor communications.



Solving the Problem

The late C. F. (Boss) Kettering of General Motors Corp. once said: "Use of tetraethyl lead in gasoline made it possible to change our designs so that we could improve an engine's efficiency by 35 per cent."

We need a drop of tetraethyl lead in people too. Even the improvement of a percentage point or two would do wonders. One labor observer who spent 18 months visiting plants gathering material for a book on productivity has this conclusion: "The competitive significance of differences in employee efficiency, as an over-all competitive factor, is growing in importance. Significant differences in employment costs among companies exist and are attributable to differences in worker efficiency. Look at the most profitable companies, and you will usually see firms that make the best use of their human resources."

Here's the conclusion of 200 company presidents at an American Management Association seminar last summer in Hamilton, N. Y.: "People are industry's most important problem."

So what do we do about them?

Basically, the answer is to set clearcut company goals (Page 117). After the goals are set, plan how to hit the target. Next, people are needed to run the key spots. After the key people, you need competent persons to help them. Then you should have controls and checks to determine if your people are doing the job—a particularly troublesome problem.

Work measurement studies for production workers are commonplace, but research on measuring the performance of nonsupervisory whitecollar and supervisory forces is in its infancy. One approach that holds promise has been developed by Norair Div., Northrop Corp., Hawthorne, Calif. It's called PACE (Performance and Cost Evaluation).

It's a statistical measure of group effectiveness in performing assigned tasks. It correlates the percentage of working "pace" with other cost controlling factors into a single weekly cumulative chart. The other factors include percentage of sched-

ule produced, percentage of personnel change, budget realization, and indexes of quality and part shortages.

When you have plans to achieve goals, people to carry them out, and means of checking on how the people are performing, you have the skeleton. You still need the sparks of life.

The sparks are good communications, good motivations, good leadership.

Honesty is fundamental to good communications. Establish a reputation for the straight, complete facts, and you will have made big gains in the competitive race with unions for people's minds. While both what and how you communicate are important, the "what" is more so.

Good communications motivate most men because they give them a sense of participation. They must also get as much say as possible in the operations, so they have a voice in their own destiny. For the future, they want predictability more than security.

With the right goals, plans, people, communications, and motivations, you practice leadership. But leadership is even more. It's the quality a coach has in spurring an underdog team to victory. It's the ability to recognize and develop attributes that people scarcely know they have.

Ten Ways to Boost Your People's Efficiency

1. Know where you're going.
2. Know how you want to get there.
3. Pick the right people to help.
4. Let them know what you're doing and why you're doing it.
5. Know what motivates them.
6. Give them the right tools to do their job.
7. Demand their best effort; don't settle for less.
8. Reward them fairly for their best effort.
9. Lead them, or they'll lead you.
10. Follow through: Check performance, praise progress, point out problems, appraise results.

Can the Government Help?

Washington agencies can give invaluable aid in revitalizing our people power by doing more research in the measurement of productivity. We have trouble defining the term because we don't know enough about it. The Bureau of Labor Statistics' measure of productivity is expressed in terms of output per manhour but really means output from all resources per manhour worked. Although the bureau cautions that its data "should not be regarded as precision instruments," some unions and other groups disregard the qualification.

An effort at measuring productivity that looks promising is called "total factor productivity." Its developer, Dr. John Kendrick of the National Bureau of Economic Research, combines the manhours of input with a presumed measure of other resources used by business, as indicated by an index of tangible capital employed. The combined measure of input better reflects management's use of more productive equipment, improved materials, and higher levels of technical proficiency along with any contributions from employee skills and cooperation.

Another possible aid from government may be the establishment of labor-management productivity councils. Sen. Jacob K. Javits (R., N. Y.) introduced a measure calling for such groups in the last Congress. It got nowhere, but he'll try again in the 87th.

A Bureau of Productivity Councils would be administered by the secretaries of commerce and labor. Bureau field offices would assist industry, labor, and communities which want to establish councils. The councils would help increase productivity, foster better labor-management relations, prepare for automation and its displacement problems, and promote the upgrading of skills.

Says Senator Javits: "U. S. work stoppages due mainly to labor-management disputes totaled 340 million mandays lost in the last decade—equal to $15.6 billion worth of U. S. production. That's almost as much as we spent on economic aid to underdeveloped nations during the 1950s."

The Payoff Looms Large

Improved use of human resources leads to stable prices, full employment with shorter hours, and a higher scale of living. But it does even more than that; it adds to people's worth.

The transformation is akin to what can happen to a bar of iron. As plain metal it's worth $5. Its value becomes $10.50 when it is converted to an alloy and fabricated into horseshoes, $4285 when made into needles, and $250,000 when turned into balance wheels for watches.

• Bound reprints of the study on People Power are available at $2 a single copy; prices for larger quantities on request. Write Reprint Dept., STEEL, Penton Bldg., Cleveland 13, Ohio.

PEOPLE POWER

Your Most Wasted Resource

More than 50 years ago, William James, the American philosopher, said that the average man uses less than 10 per cent of his ability. It appears that little, if any, progress has been made since. For example, if yours is the average metalworking plant . . .

- **You probably have ten clerical employees doing the work of four.**
- **Ten maintenance people doing the work of five.**
- **Four engineers doing the work of three.**
- **Six production workers doing the work of five or less.**
- **And you are working far below your capability.**
- **And effectiveness of all your people is downgraded by the inefficiency of the majority.**

THOSE ARE the conclusions of STEEL's editors who have just completed exhaustive research into the productivity of metalworking's people. The conclusions are based on observations in more than 200 plants, plus depth interviews with executives, management consultants, industrial psychologists, labor leaders, industrial engineers—the whole spectrum of metalworking employees.

Metalworking will spend $58 billion for people power this year—at least a dozen times as much as the industry will spend for new equipment. But metalworking will apply far less science to the purchase of people power than to the purchase of machine power. The industry will do less research into the nature of its human resources; it will apply less science to the measurement and control of its return from the dollars invested in people than it will on the return from dollars invested in machines.

Problem Is Critical

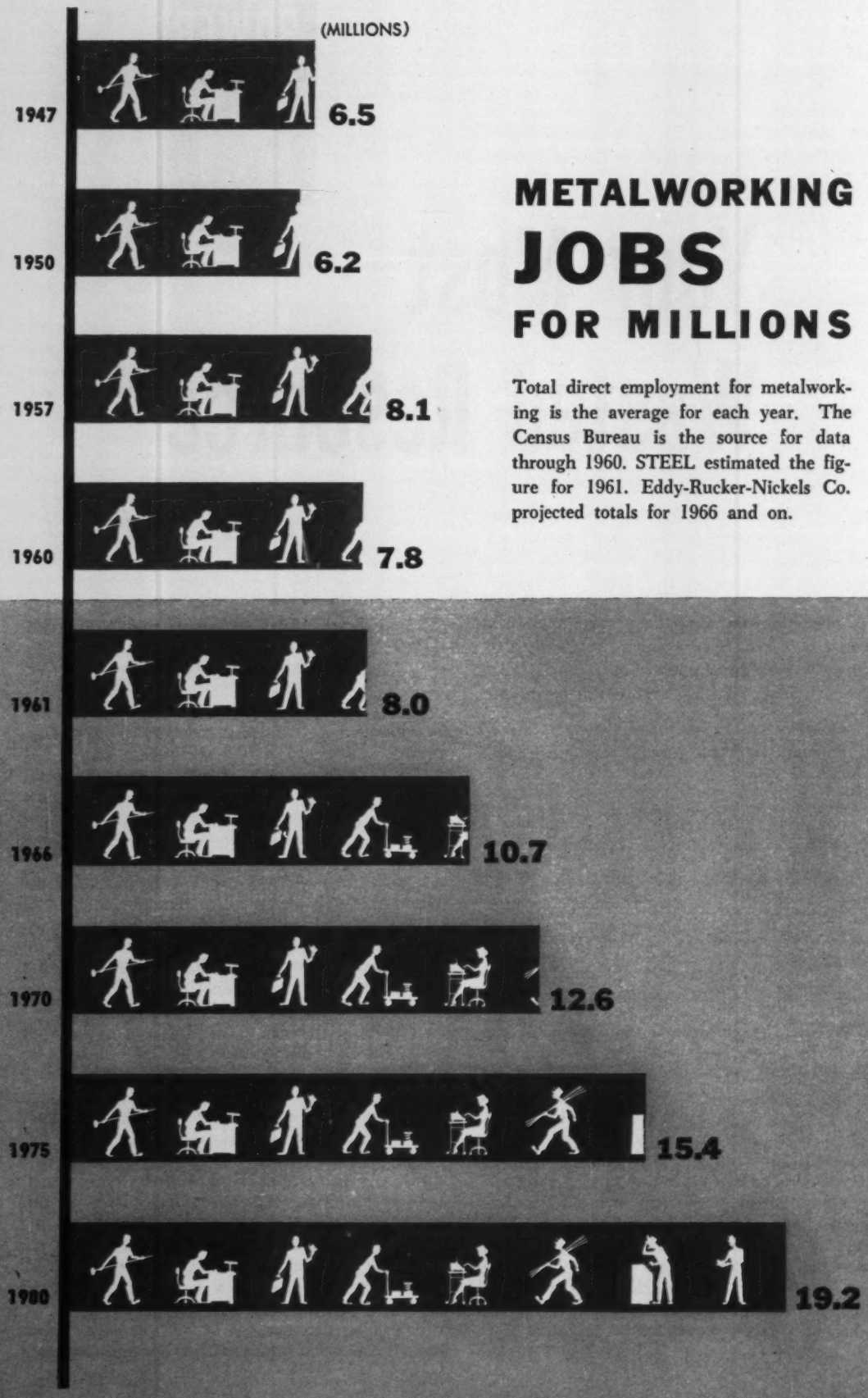
It's mandatory that industry raise the productivity of its people. The very existence of the free enterprise system is threatened. Nikita Khrushchev has declared economic war against the U. S. Soviet industrial production could surpass ours during the lifetime of most of the men who will read these words if both countries maintain their present rates of growth. But U. S. industry can win the economic war—and prove the superiority of the free enterprise system—through better use of human resources.

Profits are the lifeblood of our free economy. Their level and trend determine future capital investment and outlays for research. So profits are the key to the rate of our long term economic growth. What is the present profit trend?

In 1950, profits were 9.4 per cent of national income, but they shrank to 6.1 per cent in 1959. In the same time span, compensation of employees (including fringes) rose from 63.7 per cent to about 70 per cent of national income. Current indications are that the trend will worsen.

The problem is the cost-price squeeze which narrows profit margins. E. A. Cyrol, Chicago management consultant, reports: For manufacturing corporations, aftertax profits as a percentage of the sales dollar have dropped from 6.5 per cent in the late 1940s to about 4.5 per cent in the late 1950s. The trend would indicate a return of only 3.5 per cent by 1964.

The difference between a 6.5 per cent return and a 3.5 per cent return is directly dependent upon



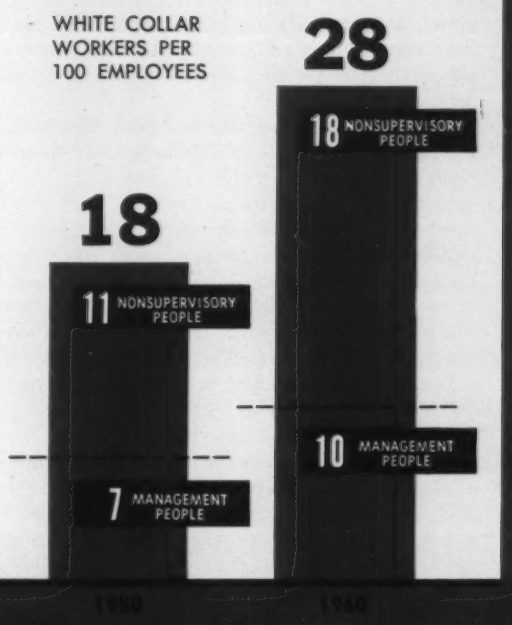
METALWORKING JOBS FOR MILLIONS

Total direct employment for metalworking is the average for each year. The Census Bureau is the source for data through 1960. STEEL estimated the figure for 1961. Eddy-Rucker-Nickels Co. projected totals for 1966 and on.

Shift to Whitecollar Workers Jumps More than 50% in Decade

The bar graph at the right shows what has happened in all metalworking. Blue collar, or hourly, proportions have declined correspondingly. In the table below, you can see the percentages in the three job classes for each metalworking segment in 1957. All figures are estimated by STEEL, using government data. The production group includes production, maintenance, shipping, and related personnel. The nonsupervisory whitecollar class includes clerical, technical, and sales people. The management category encompasses all supervisory personnel from foremen to chairmen of the board.

	Nonsupervisory	Production & Related	Management People
Ordnance	24.3%	66.4%	9.3%
Primary Metals	14.5	76.1	9.4
Fabricated Metals	15.5	75.3	9.2
Machinery (exc. elec.)	17.8	73.2	9.0
Electrical Machinery	18.9	73.1	8.0
Transportation Equip.	16.1	75.1	8.8
Instruments	23.5	67.3	9.2



the level of productivity—how efficiently each industrial employee discharges his responsibilities. It's management's function to control that level of efficiency.

After a research assignment for the International Committee for Scientific Management which took him to 81 countries, John Shallenberger, president, Connelsville Corp., reported: "Only 12 per cent of the world's managers really know what they're doing (in the management sense). The rest—88 per cent—have failed to benefit from the application of a scientific approach to the art of management. And most remain blissfully unaware or unconvinced of its virtues."

Mr. Shallenberger continued: "Most U. S. managers prefer to manage by intuition and have yet to accept, learn, or apply management fundamentals in their work."

Most of those managers probably have failed because they do not recognize the first tenet of effective leadership: Management is the development of people, not the direction of things.

The ineffective manager is less likely to maintain a respectable profit margin today than in the past. Reason: In the past, he could raise his prices to offset the difference between higher costs and the level of productivity. Today, he can't do that. If he does, he will likely lose business to foreign competitors—or to sales starved domestic rivals.

The only answer: Improve productivity. How? Use human resources better.

People always have—and likely always will—work at a level below their capability. But three interrelated trends are working against efficiency and threatening to cause even greater waste of human resources. The trends: 1. Mounting affluence of the employee—be he president or production worker. 2. The increasing complexity of industry. 3. The rapid rate of technological change. From these trends stem many of the causes for low efficiency.

Age of Affluence

Since 1950, the average U. S. factory worker's weekly wage has risen 51 per cent; his real earnings (adjusted for inflation) have climbed 24 per cent. The metalworking production worker has fared better than the average. In primary metals, for example, real earnings have increased almost 40 per cent since 1950.

That increase in purchasing power has given the average U. S. industrial employee a degree of affluence unmatched in history anywhere in the world. He can, for example, buy a pint of vodka with the wages from 1 hour 22 minutes of work (vs. 6 hours 19 minutes for the average Russian worker).

And the U. S. worker today can afford to spend a greater part of his earnings than he has been able to in the past. Reason: He has sources other than wages for emergency care and retirement needs. Employers spent $15.4 billion last year to provide for the security of employees (vs. less than $2 billion in 1940). From 1949 to 1959, contributions by employers to private pension and welfare funds increased 280 per cent; contributions to old age, sur-

vivors, and disability insurance climbed 266 per cent. Employer payments for employee security now equal 6.8 per cent of an employee's compensation (vs. 1.2 per cent in 1935).

Increasing affluence has not been limited to the worker. The American Management Association reports that top executive compensation has been increasing annually by an average of 5 per cent. Even during the 1958 recession, 40 per cent of the nation's top managers got pay boosts. And top management is getting more of its wages in the form of security, or stability payments. Only about 80 per cent of the average executive's total compensation is now paid in salary, AMA reports. About 6.5 per cent of his salary is going into contributions for retirement programs. Also, his earning level today is less dependent upon the short term business cycle—bonus and incentive payments amounted to 17.8 per cent of the executive's total compensation in 1951 but only 13.9 per cent this year, says AMA.

It's obvious that the U. S. industrial employee can own much more real property than his European counterpart. But industry observers are concerned—they see indications that the affluence tends to bridle the competitive urge.

How much human effort is wasted has never been satisfactorily determined. Most measures of "productivity" are really measures of output per manhour. And, often, the real reasons for a rise or fall in output per manhour are such inputs as capital, innovation, materials, and a host of other factors. The level of productivity in a company, while directly dependent upon human efficiency, is actually the output from all sources. The complexity of factors that result in productivity increases and decreases make the measurement a difficult process.

Some experts propose that such measurements be abandoned, that they really don't attack the real question: How efficient are the people in the organization? Perhaps the answer lies in measuring the individual, rather than the whole company. Standards of performance can be set for all nonsupervisory functions—and some people claim for the supervisory as well.

Measuring the function of the individual, setting a standard for performance, and then measuring actual performance against the standard have been done for years. It's the basis of nearly all incentive plans, and it's being adopted by more and more companies for indirect—as well as direct—labor. But another difficulty arises here: Sometimes, the function is measured inaccurately, and the standard is set too low or too high. So through human error, human efficiency is incorrectly estimated.

Measuring the efficiency of a managerial or professional employee is even more difficult. The "creative" tasks involve complex intangible factors that are difficult to gage and control. But, in nearly all cases, management can develop a ratio and judge the individual's performance by how much he improves—or fails to improve—that ratio.

Age of Complexity

The second trend that aggravates people efficiency is the bewildering complexity of today's industrial structure. And it's getting more complicated daily. Check these facts, for example . . .

- The human race has taken at least 200,000 years to develop the current global population of 2.5 billion; we'll double it in 35 years.
- There are about 4.7 million business concerns in the U. S. today—and the number is increasing by about 75,000 annually.
- More and more firms are becoming international organizations. U. S. exports, plus goods produced abroad through licensing arrangements, plus the production of U. S. branch plants abroad, will exceed $50 billion this year—or about equal to 10 per cent of our own gross national product.
- Growth of domestic industries has been phenomenal too. Steel ingot capacity today, for example, is about 150 million ingot tons vs. only 100 million in 1951.
- In 1951, there were 21,000 metalworking plants in this country employing 20 or more. Today, there are 29,700.

Changes such as those have brought about an industrial structure that bears little resemblance to its predecessor of 50, or even 15, years ago. Business today is conducted on a much broader scale, at a much faster pace, with problems that are exceedingly more complex. Management has failed to fully adapt to the change, and waste of human resources has been the result.

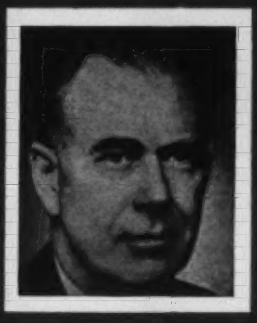
Age of Confusion

The rate of change has probably been the cause of more inefficiency than has change itself. Technology is advancing so rapidly that what was revolutionary a decade ago is merely evolutionary today. Such pressures have made the manager's role so difficult that authorities insist only a relative few of today's executives are actually well qualified for positions of top authority. Think, for a minute, about these facts:

- 95 per cent of all the scientists who ever lived are alive right now.
- 30 years ago, we spent 0.1 per cent of our national income on research; today, we're spending 2 per cent, and we fear that it's not enough.
- Ultrasonics, a new word to many metalworking managers, is about to enter all our lives. Sound waves will wash dishes, disperse fog, weld one metal to another without heat, help decontaminate radioactive parts, beat rugs, change flavors of foods, perform surgery without a knife, and make salad dressing so it won't separate, Westinghouse Electric Corp. reports.
- Thermoelectricity, a principle not even understood by many managers, is getting ready to change their

"Nine times out of ten, the inefficient manager becomes so not because of lack of training or information, but because of evading the hard decisions."

LUCIUS D. CLAY, Chairman, Continental Can Co. Inc.



"Almost every industrial organization has a warehouse filled with people, neatly packaged and stacked in rows, who never will move even as far as the loading dock."

ROBERT E. LEWIS, President, Sylvania Electric Products Inc.

products, marketing patterns, and standards of performance. It will convert heat to electricity (or electricity to heat—or to cold) without moving parts. It could power autos, submarines, space vehicles. It provides the cooling effect for water coolers, refrigerators, instruments, air conditioning. Its potential uses are countless.

• Add explosive forming, cutting, and welding. And fuel cells. And magnetohydrodynamics. And semiconductors. And nuclear energy. And the hundreds of other new items and concepts that are changing the face of industry.

• Then add communication changes. Example: People in the U. S. make around 275 million telephone calls a day. We have about 60 million television sets. Soon we'll be transmitting TV shows around the world by bouncing signals off manmade satellites. Add the fantastic possibilities of computers. Even the pushbutton is becoming obsolete; some electronic devices accept voice commands.

• Then add the startling changes taking place in marketing, finance, and other areas.

The sum: Our rate of change is almost too rapid for comprehension.

The result has been to give management more and more alternatives in making each decision—with the price of error multiplied. The executive who has failed to keep pace has become confused. In an effort to make the right decision, he has demanded more and more facts—but he has paid too little attention to the manner in which the facts are gathered. That has brought about the . . .

Age of the Bureaucrat

Management's reaction to rapid change has often been the building of giant armies of whitecollarites. The result: Bureaucracy in industry.

Today we have 28 million whitecollar employees. How much profit propulsion does industry get from that giant force? Listen to the experts . . .

• "Efficiency in the average office is only 30 to 40 per cent"—E. A. Cyrol.

• "The efficiency of whitecollar workers has fallen by more than one-third in the past decade"—John Patton, Chicago management consultant.

• "Most clerical people are not doing any more than about half of what they should be doing"—A. J. Apgar, manager of methods planning and data processing, Clark Equipment Co.

Most office inefficiency can be traced to one or more of these faults: 1. Ineffective supervision. 2. Poor training of officeworkers. 3. Poor scheduling of work. 4. Just plain overstaffing. 5. Duplication of work. 6. Unnecessary work. 7. Procrastination and intentional featherbedding by office employees.

Mr. Cyrol singles out poor training as one of the most serious causes. He points out that the new girl in an office usually learns from another girl who learned from another girl who learned from another girl, *ad infinitum*. The new employee seldom gets a clear picture of her duties, observes that her companions work seldom or slowly, and follows suit.

The Bureau of Labor Statistics made productivity studies of 19 industries. In 18 of them, the figures

"Great masses of men work constantly at points below their top capacities. We must help them to rise to their opportunities."

HENRY FORD II, Chairman, Ford Motor Co.

show that output per production worker has been rising more rapidly than output per employee. Management has devoted much effort and many dollars to improving the productivity of bluecollar personnel—through new equipment, standardized methods, improved procedures, better working conditions. Management has devoted little attention to its growing swarm of whitecollarites.

As Mr. Cyrol points out: "Management must turn its attention to the improvement of worker efficiency in the areas generally ignored in the past—the indirect and service workers."

First attention might be given to the quality of supervision in those areas. Listen to Dr. Robert N. McMurry, Chicago industrial psychologist: "So strong are the pressures toward bureaucratization that any group of 100 or more employees, if not carefully controlled, will almost certainly turn into a bureaucracy within five years. Once that happens, the bureaucrats begin to perpetuate themselves. This is easy since most supervisors select their subordinates and nearly everyone selects his subordinates in his own image. Moreover, a weak department head invariably tends to select someone who is weaker than he and hence no threat to him. When this selection of weaker subordinates has been repeated several times—particularly in an organization with many supervisory echelons—the low man in the hierarchy is often weak indeed. It requires only one bureaucrat in the hierarchy to insure that everyone below him will be as inadequate as he is himself, or more so."

When this weak supervisor is in top management, the whole company suffers. And many weaklings have risen to such heights. That's one of the causes for another trend of the times, the . . .

Age of the Committee

"We're breeding a race of frightened men—payroll cowards guided by their associates' approval." That's how one executive sees today's passion for management by committee. Should we then damn all committees? No, says Clarence B. Randall, former chairman of Inland Steel Co. and special adviser to President Eisenhower. "I merely would like to see them restored to their proper function. That function is advisory."

Most experts agree. Management committees are necessary. They are useful in developing all aspects of a problem in obtaining information and recommendations, in communicating the decision factors, and in gaining support for the final decision.

But the decision itself must not be delegated to the group. The executive who relies on a group to make his decisions evades, dilutes, and surrenders his own responsibility. He should listen to a fact gathering group to lessen his chances of making a bad decision, but if the committee becomes a refuge for cowardice, it is a great menace.

Says Mr. Randall: "For the vacillating executive, the committee form of administration is heaven sent. Beset with doubt, torn with misgivings about whether to go ahead with the plan before him, he turns to the group. He does so for the same reason that a lone elephant rushes toward the herd when he scents danger. Like the elephant, he does it with a certain amount of dignity, and juniors are flattered when the big boss seeks their counsel. Yet, the truth is that deep down he is afraid. He really wants someone to make up his mind for him, and he cannot fail to reveal this by his conduct in the meetings. The high respect which was felt for him when he was inaccessible is dissipated; discipline falters; his voice loses its authority."

Committees are inherently inefficient. A group decision dilutes responsibility, and there is no clear individual accountability. Groups stifle initiative and produce decisions based generally on the lowest common denominator of thinking. They tend to inhibit originality so that the really good thought is silenced by timidity or a desire to conform and win approval. Delegation often evades the problem or defers the decision. "And sometimes a group decision is merely the result of one man's thinking any-

"Constructive rebelliousness—the refusal to accept the status quo—is the hallmark of the man on his way up. Too many firms are frankly afraid to be creative."

DR. ROBERT N. McMURRY, President, McMurry Co.

way. The dominant individual can swing the thinking in his direction, be it right or wrong," says E. A. Butler, New York management consultant.

In or out of committee, every industrial organization faces tough communication problems today. This is a natural result of rapid change, specialization, and size. Because each man's outlook has been limited to one particular aspect or function of the business, he has great difficulty understanding the problems, needs, goals, and accomplishments of the other segments. The other men don't talk his language — the jargon of his specialty — and he doesn't talk theirs. That leads him to underestimate the difficulty of the other men's problems. His narrow background also tends to lead him to believe that his area of the business is the most vital. As Joseph Walsh, vice president-Instruments Div., Lear Inc., Grand Rapids, Mich., puts it: To solve problems, people have become superspecialized. Instead of a manager performing a function, we are setting up special groups which in turn have their own managers.

Also, many management consultants report that we have become a race of poor listeners. Our attention is demanded by so many diverse quarters —from wives to TV announcers—that we tend to automatically close our minds to the words flowing into our ears. This leads us, when on the job, to "listen intellectually"—for the verbal statement alone. Bias also bars understanding. We might decide from looking at the speaker that he has nothing to contribute; or some word or phrase might so cut across our prejudices that we just stop listening. Then there's boredom. Your thought speed is four to five times the usual speed of speech.

The communication problem is one of the most serious causes of inefficiency. One common result, points out J. D. Ardleigh of the Research Institute of America Inc., New York, is that the subordinate doesn't fully understand what the superior wants him to do. So the subordinate makes a lot of false passes.

Age of Conformity

"Conformity in behavior is a human necessity; conformity in patterns of thought is a human danger." That's how Robert E. Lewis, president, Sylvania Electric Products Inc., pinpoints the crux of the conformity question. Jack Staehle, vice president, Aldens Inc., Chicago, puts it this way: "The successful nonconformist conforms most of the time. He only fails to conform when it is necessary to reach a goal." Or as Dr. James N. Farr, New York industrial psychologist, puts it: "Thoughtful conformity is good."

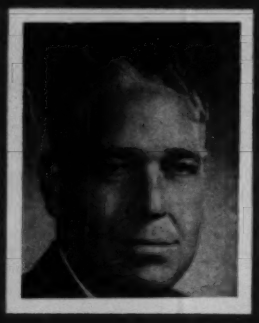
The point: Good executives do not confuse appearance and substance. They conform in routine matters to minimize waste motion and save their nonconformity for areas that really matter.

Says Mr. Butler: "Many business firms, according to their ads, want executives who are imaginative, aggressive, and possess leadership qualities. Yet all too often, the man chosen gets the job because he is sober, gregarious, well liked, inclined to co-operate with the majority, and knows how to wear a gray flannel suit. Employers spend too much time looking for stability and conformity when what they need is originality and courage."

Conformity is wasteful. It blocks creativity. It stifles individual initiative. It thwarts the aggressive man who wants to produce to the limit of his capability. It's the germ that begets industrial decay. Inbreeding—the hiring of people who think and react similarly—leads to sterility of ideas. And that results in rigidity (or rigor mortis).

Age of Security Seekers

Most people today feel a degree of insecurity. But instead of seeking security in their own capabilities, many seek the security of the group, an avenue of escape that industry has conveniently kept open. For industry, this mass insecurity means a shortage of good people at the top and an excess of



"What has happened to the urge to compete and the willingness to get down to work? They seem to have given way to the age of the goof-off."

HARVEY WHIDDEN, Vice President, Bulova Watch Co.

"I believe that the average, over-all effectiveness of the best managed U.S. companies is under 10 per cent."

PATRICK E. HAGGERTY, President, Texas Instruments Inc.

mediocre people at the middle and lower management levels. Dr. McMurry explains it this way: "Aggressive individuals with the capacity to take calculated risks . . . usually leave the company voluntarily or are forced out by conflicts with existing top management. In contrast, only those persons who need the security of a routine, regimented, and essentially protected field of activity remain for the 20 or 30 years required to reach the top by seniority. Here they may be cautiously good administrators of an established business—but rarely do they infuse it with new life and spirit and rarely are they able to meet emergencies. Large corporations have a specific attraction to those with an unusual need for security and so come to have a disproportionate share, a supersaturation, of the passive, dependent, and submissive."

The quest for security is natural, and it can be provided in an orderly manner without stifling initiative. Clarence Randall explains: "No worker comes on the job alone. He carries with him affection for his family and devotion to all the plans and purposes which give meaning to his life. Effort is response to the desire to achieve cherished objectives. Threaten those ideals, suggest that those purposes may be frustrated because of economic insecurity, and reduction of effort inevitably follows. But give him an abiding sense of continuity and certainty of fair play from his employer in the sharing of mutual adversity, and you bring into play one of the strongest motivating forces in human character—loyalty."

Age of Distrust

A degree of security contributes to higher productivity, as Mr. Randall has testified. But some unions have tended to push for workers' security in forms that, in the long run, seriously endanger their security. One of these forms is the placing of limitations on the freedom of the employer. He must be at liberty to change his policies and practices to adapt to changing competitive conditions; he must have the right to introduce new processes of manufacture, to change the nature of a job, to use his work force efficiently, free from featherbedding and makework restrictions.

Current resistance to technological change by some unions is an example. New processes which improve productivity will increase employment in the long run, even though the short term effect might be displacement of some jobs. Most union leaders recognize that fact, but most are afraid to go along with it. Their members don't understand it, and the leaders are dependent upon the members for their jobs. Management has sometimes tried to communicate the fact to workers but has generally failed to make its point. Why?

Largely because a wall of distrust has been built between management and the worker. As Mr. Cyrol puts it: "When management representatives foretell

great doom if certain labor demands are granted, and when that doom does not come after the demands have been granted, labor is not likely to look to management for leadership. Labor will tend more and more to disbelieve what management says. The man in the shop is certain that management is against him and the union is for him because he can be told that management said that pensions would ruin business; that paid vacations and holidays would stop business dead in its tracks; that insurance payments would be too great a load for the company to bear; and that workmen's compensation insurance was all wrong and would bring destruction to business. It is regrettable that this trend continues because the businessman continues to be against everything that is later considered progressive. How can he hope to win back any of the leadership that once was his?"

Too often, management has been completely without empathy, Dr. McMurry points out. Management has lacked the capacity to put itself in the worker's shoes. The union is the worker's sole defense against such a position.

The heart of the problem lies in management's failure to communicate effectively with its employees. Someone asked Al Zack, director of public relations for the AFL-CIO, why union publications were more effective than those of management. He replied: "I think it's because we do not talk down to people." Business communicators have been slow to examine union techniques and profit from them. This reluctance is often justified by such statements as, "Unions can say anything; we have to tell the truth."

"Alibis such as this are not altogether valid since the theory that union strength rests upon the telling of falsehoods is, to say the least, highly debatable," asserts Robert E. Vivian, editorial and research director, Employers Labor Relations Information Committee Inc. "Union officials are highly successful communicators. Year in and year out, they communicate in terms of mutuality—you and your job, you and your pocketbook, you and this union, you and this plant, you and this nation. The 'you and us' is always first, and this controlling motivation is in stark contrast to the cold aloofness of much of management communication.

"Communication centered in the ability to reach the individual as an individual is widely applauded in other parts of our society, yet business communicators find the lesson difficult to learn. Good communications will not end strikes or eliminate unionism. What it will do, unerringly when practiced over a period of time, is emotionally identify the individual with the company. That is a gain of the most profound magnitude."

The key to power in labor relations is the allegiance of the workers. If management is to succeed, it must win and hold a substantial share of its employees' allegiance. Says Dr. McMurry: "This is one of the most demanding and urgent problems which faces management today. The employee who has little allegiance to the company not only is a potential striker; he is also prone to leave on short notice, to have a poor attendance record, to be a substandard producer, to waste materials, to abuse equipment, to be difficult to supervise, to mistreat patrons, and in general to become a missionary of ill will for his employer."

The challenge to U. S. management then, if it is to raise the productivity of its people and regain a position of industrial supremacy, is to take the initiative in bringing about a new industrial era, the . . .

Age of Leadership

Dr. McMurry hurls the challenge: "Top management has largely abdicated its role as leader because it has been too preoccupied with its day-to-day administrative problems. It has had excessive concern with things rather than people. The role of leader has been largely pre-empted by unions and government. The task which faces management is to reverse the trend, and play, once again, the part of a leader—one who can capture the loyalty of employees. To the extent to which this type of leadership can be found, business will again assume its legitimate place in society, not only from the standpoint of insuring productivity and efficient business operation but also of offering employees the sense of direction which they so desperately need."

What are the qualities of leadership? STEEL posed that question to four men who have proved their ability as industrial leaders. Their answers:

- "True leaders, whatever their fields, have one characteristic in common—their ability to create in others a desire to be identified with them and to help reach the goals they set forth"—Logan T. Johnston, president, Armco Steel Corp.
- "In influencing others to strive willingly for mutual objectives, the leader must radiate confidence and create an instant image of competence. This can be more powerful than any other quality"—Ray R. Eppert, president, Burroughs Corp.
- "I believe the important traits are conceptual skill and the ability to act decisively. By conceptual skill, I mean the ability to see an accurate whole picture from a series of related and even unrelated parts"—H. T. Hallowell, president, Standard Pressed Steel Co.
- "No man can be a leader without . . . the willingness to make—and accept full responsibility for—major decisions"—Lucius D. Clay, chairman, Continental Can Co. Inc.

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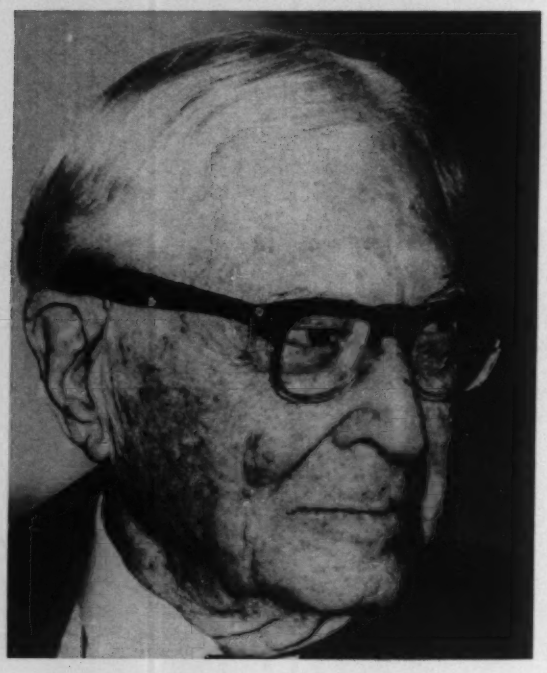


PEOPLE POWER

In dog-chasing-its-tail fashion, labor demands higher wages because living costs have risen. Management counters: Prices must be increased because of higher labor costs. Caught in the middle is the consumer, who is not represented at the bargaining table.

In his new book, *The Public Years*, Bernard H. Baruch takes both labor and management to task for their actions. STEEL obtained permission from the publishers, Holt, Rinehart & Winston, to reprint these excerpts. They spell out the challenge.

Baruch:

'Neglected Responsibility'

In 1919, Mr. Baruch was chairman of the National Industrial Conference convened by President Woodrow Wilson to achieve labor-management peace. Mr. Baruch relates his experience this way:

"Although I sympathized with labor, I was nevertheless impressed in those conference meetings that labor seemed to care no more about the public interest than did industry. Of course, there was a great deal of lip service, as there always is, to the 'general good.' But neither labor nor industry was then, or is now, overburdened with a sense of responsibility to the consumer, who alone remains unorganized; the consumers, in fact, are today one of the few groups not represented in Washington by a powerful lobby. Actually, the costs of the perennial struggle between labor and management have been passed on increasingly to the consumer.

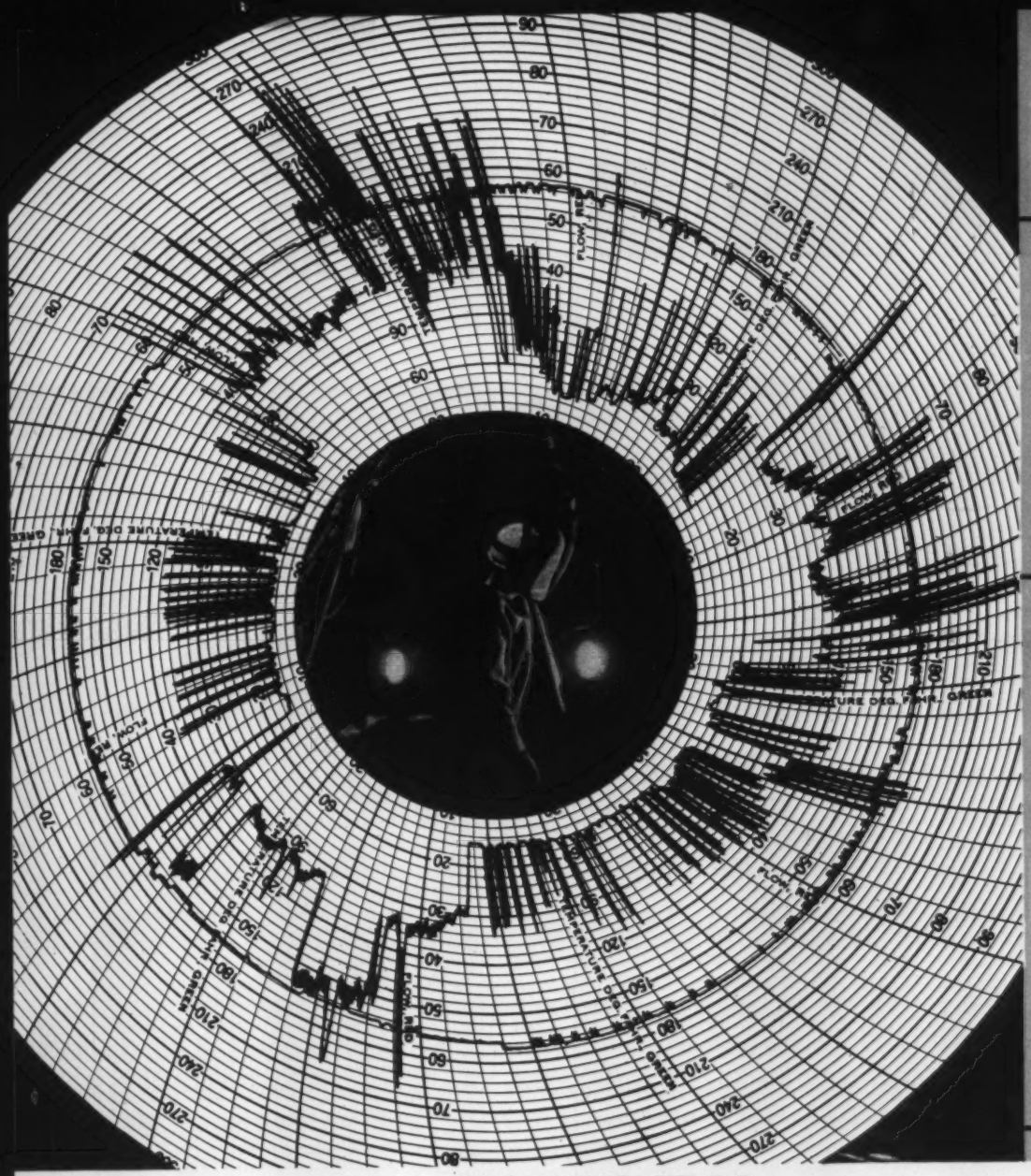
"Since that abortive attempt in 1919 to bring harmony to the industrial scene, the economic and political power of labor has grown tremendously... By abusing its powers, labor injures not only itself but the whole country. While it is the proper concern of union leaders to improve the lot of their followers, they must recognize that their demands must be economically justified. If wage and other demands are not accompanied by increased productivity, inevitably, prices will be out of reach, and foreign competition encouraged to the detriment of the entire economy. American workers will wind up as the highest paid unemployed workers in the world . . . Unless labor leaders recognize this threat, they may well wind up 'unionizing' unemployment. . ."

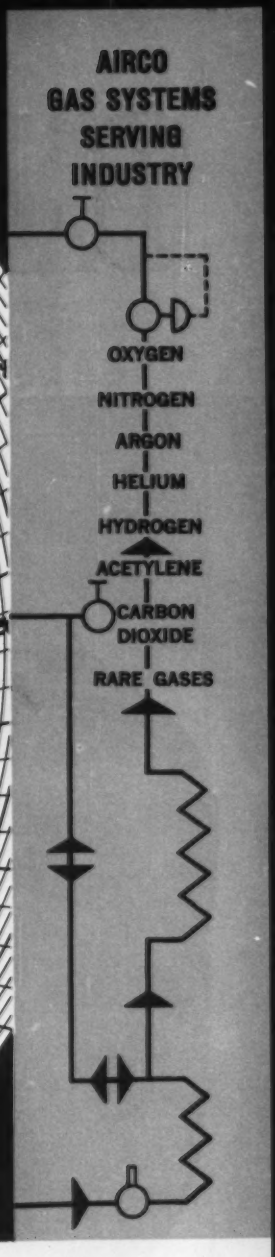
In discussing the inflationary problems of the U. S. following World War II, Mr. Baruch states:

"There was not much attention paid (to) . . . anti-inflation prescriptions. Nor was there much attention paid to a proposal I made before the House Banking & Currency Committee in March, 1946, for the creation of a High Court of Commerce, a sort of economic council, to decide questions at issue between economic groups whose quarrels jeopardized the well-being of the entire nation.

"The idea of such a tribunal seems to me worth consideration today, in the light of labor-management wars which not only grow more bitter and prolonged, but whose effects on noncombatant consumers, on the nation as a whole, and on our world position grow more injurious. The steel strike of 1959 . . . is a case in point.

"The power of labor and management is such today that neither can win a clearcut victory over the other. Inasmuch as a sense of responsibility is not particularly well developed in either, the question is whether the nation can sit by while they fight it out—during which time the country suffers, and in the end pays the cost of these labor-industry wars. The legislation we have now is evidently inadequate to settle disputes and to protect national interest. Consequently, some sort of tribunal along the lines I have suggested seems to me to deserve study as a possible solution."





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PEOPLE POWER

PANEL OF PRESIDENTS

They Map Routes to Efficiency

Mr. Cresap:

EFFORTS to improve the productivity of employees at Westinghouse are centered in four general areas: Employee training, management development, realignment of duties to make maximum use of skills, and the creation of a climate in which employees can and do identify their own best interests with those of the company.

A well trained employee team is the most important asset of any company, and efforts directed toward improved employee performance must recognize the need for continuing development of this asset through effective coaching, counseling, and training. Thus, on-the-job training and coaching of employees by their immediate supervisors, together with the presentation of special classroom training to meet the development needs of employees, are major management responsibilities.

The leadership provided by management in supervising the work of employees is an extremely important factor in employee productivity. To develop this leadership to maximum potential requires constant attention to improving methods of management selection, appraisal, and training. Of particular concern in the training area should be courses relating to individual and group relations, coaching and counseling skills, wage and salary administration, union contract administration, and work simplification.

The effective use of knowledge and skills at every level of organization can contribute much to improved employee productivity. Greater attention needs to be given to the realignment of both hourly jobs and salary positions to utilize the knowledge and skills of individuals. For example, the separation of the creative and routine phases of the work of an engineer—with the routine being assigned to technicians—is increasing the effectiveness and morale of our graduate engineers.

The creation of a working climate in which employees perform at a high level of productivity be-

MARK W. CRESAP JR.
President, Westinghouse Electric Corp.

EDWARD L. DREYER
President, Adamas Carbide Corp.

WILLIAM M. WEAVER JR.
President, Howe Sound Co.

JOHN O. EKBLOM
Chairman, Hupp Corp.

cause they want to (not because they have to) should be a major objective of every corporation. Creation of the climate has many facets, including supervisory practices, communications, working conditions, opportunities for advancement, and compensation policies.

Mr. Dreyer:

Our biggest people wastes result from a lack of sound planning. As workers and managers, we aren't devoting enough energy to specific goals.

Too many people are interested in their jobs or careers second . . . in security and a pleasant environment first. They don't have that burning ambition and desire to succeed.

This is a dangerous attitude and breeds inefficiency. The situation has reached the point where many people feel if they don't do anything overtly dishonest, they have a vested right in the job.

The answer is to motivate people through demonstrating to them that they will grow and prosper as the company grows and prospers. That's why we have profit sharing retirement for our people rather than a straight pension plan.

Another "carrot" is a semiannual management bonus that's unrelated to salary. Here's how it works: The four top operational managers under the president are given "x" number of dollars that they can apportion to the managers (down through the foreman level) under them. The share of the pie a man gets is directly related to his productivity. The man receiving a good bonus is told why; so is the man getting only a modest one.

Once a quarter, top management conducts a no-holds-barred question and answer session for bluecollar people.

One key move to stimulate productivity: A committee composed of foremen and supervisors functions as a troubleshooter, adviser to management, and does liaison work with hourly people. Besides handling tasks for top management, the committee brings two other benefits: 1. It provides the machinery whereby an individual can criticize the policies of top management anonymously. 2. It gives supervisory management a chance to see the "big picture" through close contact with other departments and functions.

Mr. Weaver:

To keep people productive, you have to maintain a spirit of enthusiasm within an organization, all the way from top management down through the bluecollar ranks. This means a company can't sit still—it has to continually expand.

People need incentives, and there's no better way to create them than for a company to grow fast and offer the rewards of rapid promotion. For example, the average age of our executives is under 45. Our people know that when an opening occurs, someone in our organization is going to get a crack at it—they know we aren't going to bring in relatives, or someone else from the outside.

We demand that a manager be a friend as well as a boss to the people under him. One necessary qualification for any manager is that he have a sincere interest in and liking for people. That's why we make morale the responsibility of each manager. This doesn't mean a manager should be afraid to demand more from his people (we strive to instill in our people the idea there's no such thing as "can't"), but at the same time, we don't want people aggravated to the point where they're nonproductive.

Again, there's no substitute for enthusiasm to stim-

ulate productivity. And enthusiasm has to start at the top and be carried right down to the lowest level in the organization.

Mr. Ekblom:

The key ingredient in raising a man's productivity is to put information into his head without hurting his ego. At Hupp, that is done chiefly by clinics which demonstrate practical ways to get practical results, mainly by studying how others do it.

Hupp has taught its people how to recognize trouble developing at lower levels through reading and interpretation of available data. We had good men who didn't know how to read a balance sheet and income statement. We taught them (in 5 hours) the few things they needed to pick up from these statements to correctly use and interpret the information.

We are so sold on the philosophy of "home growing" talent that we would rather promote a man one-fourth trained than bring in an outsider 100 per cent trained. The reason: Morale.

Hupp's other approaches to motivating people can be capsulized this way:

• **Spur morale by better communications.** At Hupp this takes the form of the Key Club, composed of all members of management—from president to foreman. The club acts as a status symbol and also as a pool of manpower from which managerial promotions will be made. Through communications tools, such as a monthly news letter, managers from diverse divisions are motivated to think about the company as one unit.

• **Hold quarterly, "open door" board meetings,** where line and staff managers engage in a "give and take" session with directors. No question is disregarded; no area is "off limits." As a result of the meetings, component orders have been placed between divisions; personnel with specialized talents have been located and loaned; valuable contacts with customers, prospects, and suppliers have been unearthed; and joint purchasing agreements formulated.

GEORGE MEANY
President, AFL-CIO

Mr. Meany:

Undoubtedly there are many thousands of workers whose full skills are not being used. This is rarely due to their own choice but to lack of opportunity—a skilled machinist may be employed on a routine assembly line job because there is no work for machinists. And, of course, the problems of the Negro, solely because of his race, are monumental. This poor utilization of available skills is deplorable.

I would not deny that there is *some* outright resistance to technological change and *some* forced employment of unnecessary help in American industry. But I do not think the problem among wage earners is of any greater magnitude than, say, the employment of junior executives whose only qualification is a relationship to someone in top management.

In short, I do not believe that the inefficiency of people is a major problem. The waste from that source is beneath notice compared with the waste brought about when the steel industry, for example, operates at only 50 per cent of capacity.

But taking people waste as whole, what can we do about it?

To us in the labor movement, the basic need is full employment as a permanent feature of the American economy. The remaining pockets of outright resistance to technological change are caused entirely by fear—fear of unemployment, fear of downgrading. Unhappily, these fears have all too often been justified.

Therefore, we feel that a sustained rate of economic growth, brought about in part through federal leadership in such fields as area redevelopment, housing, aid to education, adequate minimum wages, coupled with fiscal policies that will promote buying power as well as productive capacity, is the only way to minimize people waste.

To put it another way, the efficiency of people is of little significance in a stagnant economy. Suppose over the last year, the basic steel industry could have increased efficiency by 10 per cent; the only predictable result would have been a reduc-

WILLIAM B. GIVEN JR.
Chairman, American Brake Shoe Co.

tion in operations to about 45 per cent of capacity. Who would gain from that?

Efficiency, then, must go hand in hand with economic growth and full employment. Only in this way can our country be strong at home and in the world.

Mr. Given:

Lack of good human relations is the greatest productivity killer in industry today.

People are just about as productive as the human relations atmosphere set by their managers. The greater the interest shown in a man, the more productive he becomes.

We have had plants where productivity was barely high enough to keep the doors open. We have others where employees have fought their way to the plant through blizzards and then turned out a record day's work. This shows a startling difference in atmosphere, and in every case it can be traced to one thing: The leadership of the individual manager. And the managers who get the most out of people are the ones who show the greatest interest in them.

How do you show this interest in a man?

- Be sure his job and his rewards fit his ability, ambition, and potential.
- Make sure he knows and believes his job is important.
- If you think well of him, let him know it; and let him know you expect his best.
- Don't run his job; help him to run it himself.
- Temper honest criticism with honest praise.
- Encourage his ideas. If they're no good, explain why. If they can be used, be sure he gets the credit.
- Welcome his interest in things beyond the limits of his present job.
- Help him be able to go home proud of his company, of his job, and of himself.

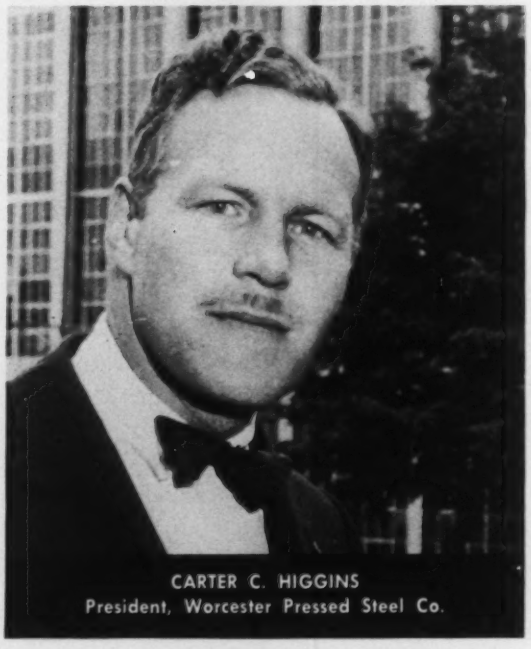
Brake Shoe also tries to capitalize on the competitiveness of individuals by seeing that all levels of plant management get a monthly statement on where their operation stands (in terms of such things as overtime, profit and loss, and safety) in relation to other company operations. This way a man can measure his performance against his opposite number in another plant.

Mr. Higgins:

Managerial inefficiency sometimes arises from outside or technical factors which limit management—such as unforeseen disasters, a suddenly deteriorating market, insufficient capital, or incompetent assistants. Those factors are usually given as excuses for ineffectiveness.

But in nine out of ten cases, the real trouble is with the type of manager himself and is more frequently rooted in his character, rather than errors of judgment. The role of his necessary hard work, patience, determination, and steadfastness may frequently be underemphasized by professional analysts.

The same analysts will shortly be urging more devotion to human relations, public affairs, participation management, development of replacements for each executive, diversification, and study of breakthrough technologies which may not be germane. The intent may be all well and good. But if in the process the manager should let his standards and the en-



CARTER C. HIGGINS
President, Worcester Pressed Steel Co.

forcement of them become diluted, he is opening the door to the tendency of work to expand to occupy the force as set forth by one of Parkinson's laws. The organization stops moving ahead.

Even under adverse conditions, it can be a distasteful thing to have to enforce basic standards. Managers, as well as others, have a tendency to let things drift in the hopes they will get better. The lack of "guts" is frequently at the base of ineffectiveness.

Nor can a manager suddenly determine to get tough (all on his own) for a while; his standards must be shared within his organization. Consequently, along with guts goes a degree of patience and willingness to plan and see through the moves that should be made.

Mr. Hayes:

While industry and its spokesmen may profess to be worried about people waste, our concern in the labor movement is with the waste of people and their skills in this period of fast moving technological advances.

I suppose the easiest way to eliminate people waste in industry is to eliminate people altogether—which seems to be the eventual objective of automation. And though the history of technological development indicates that man will eventually adjust and benefit from automation, I am deeply disturbed by the tendency of industry to ruthlessly slash job opportunities of human beings without a seeming care for what will happen to them.

Rather than engage in a lengthy discussion of "efficient use of machines and materials," I should like to comment on the cost-price squeeze.

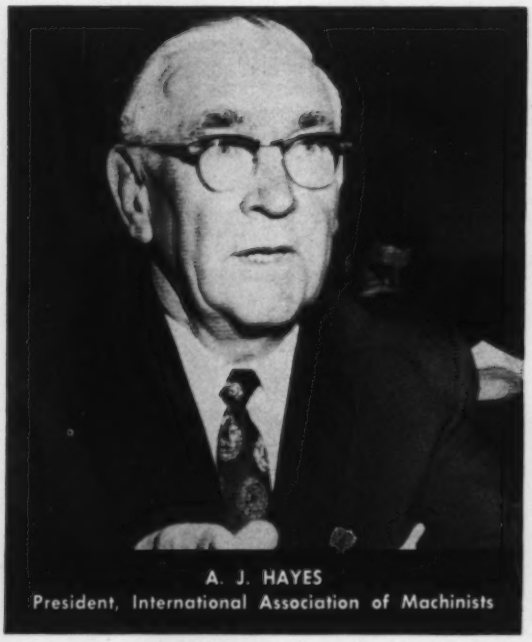
Although the labor movement in America is firmly committed to the free enterprise system (and agrees that employers have a right to enjoy a fair profit), we do not believe it is right or good for the system that the steel industry should reap a return of 17 per cent on investment while operating at less than 60 per cent of capacity, or that prices in the auto industry should be high enough to yield 20 per cent after taxes on net worth on "standard volume" production, which is attained if plants operate only 180 days a year.

These are unconscionable profits, and they lead to the kind of pricing policies that result in unconscionable waste of manpower and facilities.

I would suggest that if industry would scale down its appetite for profits to the traditional rule of 6 per cent on investment, it is quite likely that the cost-price squeeze would soon disappear in a rising volume of new consumption, stimulated by lower prices. Such a move would undoubtedly strengthen America's position in world markets.

Mr. Mitchell:

The least efficient way to use a person is to have him pushing a wheelbarrow. The most efficient:



A. J. HAYES
President, International Association of Machinists

DON G. MITCHELL
President, General Telephone & Electronics Corp.

Train him to push buttons that push lots of wheelbarrows.

We don't want our people to work harder. We want them to work smarter.

In the next decade, research and development will have to be doubled (from the present $15 billion a year). This will enable us to make more effective use of manpower as well as brainpower. In addition, greater emphasis must be placed on management development and employee training, together with more automation in office and plant. Through automation, we can release more people from clerical and production tasks to sales and service. This is using people more efficiently.

To stimulate people to work smarter, I believe in financial incentives. That's why we instituted a profit sharing plan at Sylvania some years ago.

We believe that for people to work most effectively, they must identify themselves not only with the job but with the company. You get greater performance if you can make a man see the tie-in between his performance on the job and the financial standing of the company and then let him share in the company's growth.

Yet it's not enough to realize greater manhour efficiency. The big job is to stimulate creative thinking. For the hourly worker, this is handled via the suggestion system route. For managers, it takes the form of profit improvement—a formalized program where every department has a monthly and yearly quota for improving profits by doing things more efficiently. This is far more than cost reduction. It is a case of finding new and better ways of doing things.

Mr. Olson:

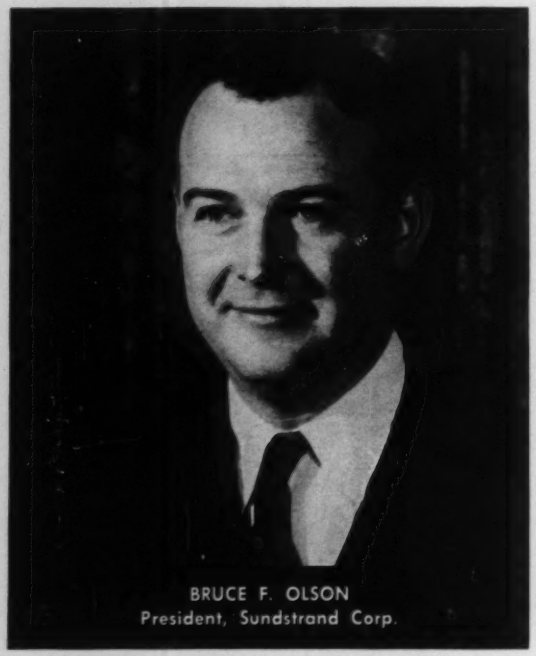
Most people are inefficient. A man's day to day efficiency is affected by his own motivation, personal aptitude, and the atmosphere in which he is working.

The biggest people wastes occur in jobs where it is impossible to set a standard of productivity, which includes the factors of energy, time, and cost. Management has made real progress in the establishment of standards wherever the jobs are mechanical and repetitive so that they may be rated against work studies and time studies. Most waste occurs in areas that are not timed, or where the efficiency is not measured to any specific degree. We know, for instance, that when we are able to time study a job on a specific machine, we can expect up to 100 per cent increase in efficiency from the average worker. I presume that if we could time study officework, we might be able to produce the same improvement in basic efficiency. But since that would be difficult to do on many jobs, we must look to other methods to improve the daily efficiency of our people who do not have repetitive and more or less mechanical jobs.

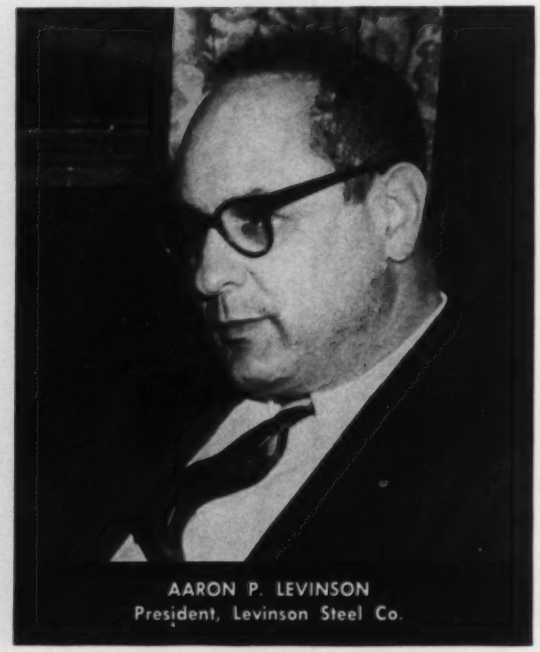
In the supervisory areas of the shop, we can use such things as the level of scrap, monthly number of labor grievances, and departmental measurements of work performed (and measure them) against some sort of historical standard.

In sales areas, we can establish quotas based upon regional territorial analyses. In highly technical areas, such as in engineering, establishing standards is far more difficult, and I believe a long

"Empire building is one of today's greatest wastes of people"



BRUCE F. OLSON
President, Sundstrand Corp.



AARON P. LEVINSON
President, Levinson Steel Co.

range view of results is probably the only practical measure of efficiency.

In the top management area, we can use the balance sheet and profit and loss statement, together with the return on assets employed, as measures of efficiency.

To eliminate time wastes in the areas that are difficult to set to standards, the most important factors include incentives, opportunities for advancement, and recognition of accomplishment. Those things can be accomplished by bonuses, personal interviews, and continued improvement in communication between departments and groups of people within a corporation

Mr. Johnston:

True leaders, whatever their fields, have one characteristic in common. It is their ability to create in others a desire to be identified with them and to help reach the goals they set forth. It is an ability founded on integrity.

I believe that every manager can learn the management skills of planning, organizing, leading, and controlling. In our company, we go to great lengths to teach and reinforce these skills.

Yet each man must develop his basic leadership ability for himself. To do so, he must begin by recognizing that those who work with him will produce far more if they are stimulated to offer their cooperation than if they are driven or coerced.

What causes inefficiency? It seems to me that a manager is most likely to be inefficient when he lacks a clear understanding of his responsibility and authority.

To be effective, he must have a firm conception of the framework in which he is to operate. He must know exactly what is expected of him.

When he does not, he is hampered in a number of ways. He is often hesitant to act. Trying to find his definite sphere, he must constantly probe and retreat. Sometimes, he may not act at all.

So a major responsibility of the top manager is to clearly define the work of the managers associated with him. There is no substitute for the old formula: Tell a man what his job is; give him the tools to do it; leave him alone to do it; hold him responsible for results.

Mr. Levinson:

Empire building is certainly one of today's biggest wastes of people. Too many men in middle management are preoccupied with building walls around their jobs. They're more concerned about personal security than they are about doing what's best for the company.

One solution is to break down the barriers—to eliminate some of the rigidity in business organizations. We do not refer to the organization chart before we enter into a discussion with anyone. We

LOGAN T. JOHNSTON
President, Armco Steel Corp.

believe the best way to promote teamwork is by talking to each other. We encourage communication at all levels.

One way to get maximum efficiency from people is to eliminate any doubts they may have about their job or their company. In addition to having thorough orientation programs for our employees—including informal meetings with top management—we have special seminars for key operating people. Once a year, we bring them together for a full day's discussion of the national economic outlook, specific factors that will affect our business, and ways that we can improve our teamwork. We get expert opinion from guest panelists—steel executives, editors, bankers, congressmen, and eccnomists.

The trouble with some of the management consultants is that they spend a lot of time making organizational charts and putting people in little boxes. They draw the boxes and then find people to fit them. I don't agree with this. I think you have to know your employees well enough so that you can tailor jobs to their talents.

When a man leaves our organization, we never try to get a carbon copy to do the identical tasks of his predecessor. We re-evaluate the staff and decide whether someone's responsibilities can be broadened to include the duties of the one who left, or whether the man who is moved into the vacant spot should give the work he has been doing to someone else, in a sort of chain reaction. After shifting people around, we may find that what we need is a new man someplace else in the organization—not in the spot that was vacated.

IMPORTED Brass Mill Products

OR

AMERICAN MADE Brass Mill Products

Which costs more?

Even if you can buy imported brass mill products for a few cents less... the real price you pay may be a lot higher.

Here are a few factors to consider should you be tempted into purchasing brass mill products made in a foreign country...

Are you sure of quality?

Your finished product can be no better than the quality of the materials you use. Products from U.S. brass mills must meet the rigid standards and specifications that were developed for your protection in the first place.

Is there anyone to back it up?

If specifications change or unexpected problems arise you can be sure of getting complete satisfaction from a reliable and *accessible* American manufacturer.

Are deliveries prompt and dependable?

Punctual deliveries can mean less capital tied up in inventory . . . greater flexibility in production planning. In periods of stress and short supply, your domestic supplier is your surest source of needed materials.

How about technical help?

U.S. brass mills have the most advanced technical facilities available to help you make a better product or improve your manufacturing process.

Have you considered the indirect costs?

The U.S. brass mill you buy from pays its share of local, state and federal taxes, just as you do. Brass mill imports represent a loss of millions of dollars in taxes which, directly and indirectly, increase your tax burden. Foreign brass mills pay taxes in their own countries.

Are you hurting your own customers?

Brass mill imports represent a loss of many millions of dollars in labor purchasing power. With the business cycle being what it is, this loss can have a serious effect on the welfare of your company.

Do you want a lower standard of living?

Foreign brass mill workers are paid about 1/3rd to 1/10th as much as U.S. brass mill workers. If American business buys from foreign brass mills because of lower labor costs . . . how can the American standard of living be maintained?

For greater value in brass mill products...

Buy from a reliable American manufacturer

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TO THE STANDARDS
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After engineering and lab analysis a specific recommendation of manufacture is made for *your* oil seal. Critical tolerance levels are established to guide the many Quality Control people who will follow your parts as they move through our plants. At any time, our QC department can halt production if they find variances in manufacture.

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PEOPLE POWER

Make It Your Strongest Asset

WE'RE getting more power from our machines via higher speeds, greater reliability, and added capacity.

Are we getting more power from our people? No, say the experts.

"In most of America today, this is the age of the half done job, the era of the goof-off, the high tide of mediocrity," charges Charles H. Brower, president of Batten, Barton, Durstine & Osborn, advertising agency headquartered in New York.

What's the payoff for fuller use of our human resources—7.8 million metalworking employees?

- On the cold war front, the nation that most efficiently uses its human resources will win. The U. S. is not conspicuously ahead of Russia; some claim we're behind.

- On the national front, more efficient use of people can mean a higher standard of living, lower prices, more sales, and added employment to meet the greater demand.

- In the export-import battle, U. S. metalworking will never be able to offset its wage and salary bill (the highest in the world) until it uses its people power more effectively.

- In your own company, for every 1 per cent that your people can improve your economic productivity, you can improve your per share earnings by 2½ to 7 per cent after taxes and other payments, says Allen W. Rucker, president of Eddy-Rucker-Nickels Co., Cambridge, Mass., consulting firm. He points out that it's more profitable to make money *with* than *out of* employees.

- Your more efficient use of your own resources can bring higher income and better job satisfaction.

Turning the Corner?

In the 1950s, physical output per manhour in manufacturing grew at the average yearly rate of less than 3 per cent, while payrolls rose at the rate of more than 6 per cent. The gap had to be made up through higher prices.

"This inflationary process, now persisting for more than 25 years (not merely since the end of World War II) is likely to continue," believes Mr. Rucker. He sees yearly earnings per employee in metalworking growing at the compound rate of more than 5 per cent through 1968. He doubts that physical output will grow that fast.

His prediction can be proved wrong only if metalworking gets more for its payroll dollar. We've already seen what powerful factors work against more effective use of people power (Page 93). How can they be overcome?

"The starting point is to know your goals in business," points out Henry W. Spitzhoff, vice president of Robert Heller & Associates, Cleveland management consulting firm. "An amazing number of companies have no clearcut goals. The objectives may have been set years ago, but they're obsolete now. Often, nobody but the president knows what the targets are. They sometimes become so blurred and distorted in transmission that they are nearly useless. Occasionally, they are too theoretical to be useful."

Mr. Spitzhoff asks: "How can a company fully use the power of its people when they don't know what they're shooting for? If you don't know your goals, how do you know what people to hire and what to have them do?"

After the goals are set, plan (on the administrative level) how you are going to hit your target, ad-

The Competitive Man

Thomas F. Morris

HUNDREDS of little red and white stickers bearing the letters "TCM" were on the walls and windows of the main plant of SKF Industries Inc. at Philadelphia when employees arrived for work one morning last August.

Next came a message: "After your job . . . TCM" was printed on table tents in the company's lunchroom. Employees later found "TCM . . . in your car" on a sticker under their windshield wipers when they left the plant.

The teaser campaign lasted a fortnight before the explanation came—first at the regular monthly meeting of middle managers, on the following day in a management letter to foremen on up, and finally in the employee publication, *The Sphere*.

"TCM stands for The Competitive Man," reveals Thomas F. Morris, vice president, industrial relations, who heads the TCM drive.

"He is the symbol of the driving force of free enterprise," Mr. Morris says. "In his talented hands may well rest the future of humanity—indeed life on our earth as we know it. SKF has chosen him as a symbol of a campaign aimed at making us a more competitive company." The program will last through January, 1961, and aims at these issues:

1. Foreign competition.
2. Manpower waste.
3. Material waste.
4. Teamwork.

The house organ, letters, meetings—almost every form of communications—have been used to inform all employees, from management to the sweeper, that scrap and careless work practices cost more than $1 million annually at the main plant.

Especially effective was a chart showing electric power used during a typical day. It indicated how machinery was turned off early before lunch and quitting time. The power load figures revealed that 100 per cent of SKF's equipment at the main plant was running for only two and a half hours during a shift—from 8 to 10 a.m. and from 1:15 to 1:45 p.m.

"The documentary proof on power was a real shocker," says Thomas A. Fitzgerald, public relations director. "As a result, work practices have improved dramatically."

Employee reaction to the entire program has been generally good. Some have even written to management: "It's about time." SKF's suggestion system has been flooded with cost cutting ideas directly generated by TCM.

Union officials protested at first, but they calmed down when Mr. Morris made it clear that TCM was directed at all employees.

The program was eight months in the planning stage, including a pilot run at SKF's Tyson Bearing Corp., Massillon, Ohio. Mr. Morris believes TCM contributed to new understanding with the union there. After recently completed negotiations, Local President Martin Gradijan wrote in the union paper: "Management's problems are our problems. So let's all begin to pull together like civilized and progressive human beings, instead of going backward to the days when unions and management were always at each other's throats."

Says Mr. Morris: "TCM costs only 10 to 15 per cent more than the usual communications program. It has worked so well in Massillon and Philadelphia that we will use it at all our plants."

vises Mr. Spitzhoff. Is the organization centralized or decentralized? Is emphasis on sales, production, research, finance? Or is it equally placed?

Next, people are needed to run the key spots. In planning business goals and then operating to obtain them, you succeed only if you have the right people at the right places. Selecting them is perhaps the toughest job of all.

After you choose key people, you'll have to get competent helpers for them.

Then you'll need controls and checks to determine if your people are doing the job they're supposed to do. Here are the three major controls you'll need to check your use of human resources:

1. Sales forecasts and comparisons with the competition.
2. Profit margin and profit-on-investment checks.
3. Controls on budgets, assets, liabilities.

If anything is wrong in any of those determinations, something is amiss with your people power.

All other controls stem from those. Merit systems, job evaluating programs, incentive plans, and many others are good. Yet, they are all tools, not panaceas. Like any good tool, they must be used and kept sharp.

Catalysts for People Power

Goals, plans to achieve the goals, people to carry out the plans, and means of checking on how the people are doing—they make up the framework within which you can revitalize your people power. But it's not enough. Your program still lacks the sparks of life. The principal sparks are good communications, knowledge of what motivates people, and the ability to lead.

In communicating, explain what you're doing, why you're doing it, and how. Techniques of transmitting that information are important, too, yet not as vital as the facts themselves. Some companies overemphasize the techniques.

What should you tell about your company? Jack S. Parker, vice president of General Electric Co., believes six facts must be explained and repeated until they are fully understood by everybody—employees, their families, their neighbors, all people in the community where the business operates, customers, and stockholders.

1. Wages are ultimately paid by customers, not by the owners or managers of business. The owner takes the risks, and the manager makes the decisions that are involved in producing goods or services.

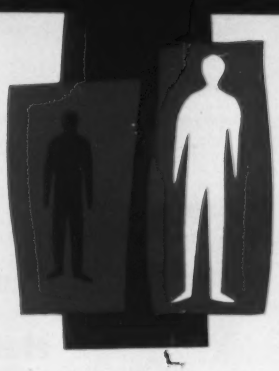
2. Inflated wages mean inflated prices, which ultimately hurt the wage earner like everybody else. The exact point at which a proposed wage increase exerts inflationary pressures may be difficult to determine and therefore subject to argument, but the principle is still true. "The sad fact is," says Mr. Parker, "that many union officials are willing to ignore the harm that inflation does to the economic interest of the union members, so long as they can get credit for always getting 'something more' with each new contract."

3. Employment security depends on the opportunity to continue producing goods and services that customers will buy and at a price the customer is willing to pay. "Each employee, no less than the company as a whole," says Mr. Parker, "must meet competition. The objective of union officials is to prevent employees from competing with one another, either in the same business or any other."

4. Competition for jobs is not decreasing in the U. S.; it is increasing. Most jobholders in this country are competing for their jobs in both the domestic and world markets.

5. If productivity improves, the benefits must be shared among workers, customers, and owners.

6. A substantial part of the gains from improving the business operation must be reinvested in research and development and in new and improved facilities. If that isn't done, the wellsprings of economic prog-



Motivating The Creative Man

A SPECIAL problem in motivation arises with creative people.

They comprise the most important human resources you have because they dream up the ideas that make American industry go and grow. Creative talent perhaps cannot be enlarged, but it can be used more productively, says Alex F. Osborn, co-founder of the advertising agency, BBD&O. Industry can encourage creativity by hiring the right people, providing them with the right supervision in the right climate.

A creative person is emotionally free, willing to share ideas, verbally expressive, often bored with people, fluent with ideas, positive in temperament, not particularly orderly in behavior but systematic in thought, impatient with people but persistent with ideas, impulsive, generally above average in intelligence (but not always), perpetually dissatisfied.

IN DEALING WITH CREATIVE PEOPLE, THE GOOD SUPERVISOR:

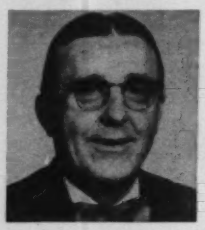
1. Genuinely delegates.
2. Gives goals, but not methods.
3. Gives recognition through title, status, and money, without burdening them with administrative duties.
4. Champions them with top management.
5. Supervises firmly, but not too closely.

Supervisors are the key to maintaining the right climate for creativity. But atmosphere must start from the top men or man, and it should spread through all departments, not just engineering and research, usually considered the "creative" parts of an organization.

THE SUPERVISOR NEEDS TO KNOW THAT THESE MOTIVATE THE CREATIVE MAN:

1. He wants to solve problems.
2. He craves personal gratification.
3. He seeks prestige.
4. He needs more money.
5. He wishes an advance in title.
6. He has a strong competitive instinct.
7. He desires fringes (like bonuses).

The right people, supervision, climate, and motivations cannot guarantee creative vigor. They can only help sustain it. The source of creativity is as mysterious as that of life itself—and just as fragile. Handle with care.



Joseph S. Kopas

Human Engineering Institute Helps Develop People Resources

HUMAN Engineering Institute is a unique organization whose function is to revitalize people power.

It's a private, nonprofit body that works under contract with industrial clients to make better use of their human resources. It was formed six years ago to supply answers to some of industry's personnel training and development problems. Republic Steel Corp. was its first client. Although the institute now has many others, Republic is still its major one.

The institute believes that poor job placement, lack of leadership, mediocrity in management, and poor workmanship are the major blocks to the full use of people power. Its director, Joseph S. Kopas, says that management has two principal tools which have been overlooked:

1. Vocational guidance, whereby proper selection, placement, and upgrading put the right people in the right jobs.

2. Training and development, whereby better job proficiency, conscientiousness, and growth improve the skills of the people and their pride in performance.

IN VOCATIONAL ANALYSIS, THE INSTITUTE IS DEVELOPING AND OFFERS:

• **Pre-employment testing** designed to screen prospective employees before they are interviewed.

• **Vocation testing and analysis** to identify candidates for management training programs and key placements.

• **Vocational counseling** for sons and daughters of clients' employees to help them better plan and prepare for careers (often with the parents' employers).

In vocational training and development, HEI leaves to the company the task of teaching the what and how of the position. It takes on the background training, which helps give the why or theory.

IT PROVIDES THESE PROGRAMS TO DEVELOP MANAGEMENT PERSONNEL:

• **Induction and orientation,** designed to give the new supervisor a basic understanding of supervisory duties, responsibilities, methods, and philosophy.

• **Four-year internship in management** provides extensive training for new supervisors aimed at building sound management philosophy and practical methodology. It features a two-phase approach —related training (class) and applied knowledge (on the job).

• **Basic economics** supplies supervisors with the facts needed to understand the operation of our free enterprise system.

• **Discussion leading** builds a sound approach to managing people and provides a method for tapping the potential of group thinking and participation.

• **Building management co-operation (BMC)** makes "management teamwork" theory a practical reality.

• **Technical management training** prepares successful supervisory personnel to assume executive positions. It stresses the top level viewpoint, philosophy, and techniques.

• Battle of productivity helps supervisors overcome obstacles that interfere with efficiency.

FOR NONSUPERVISORY EMPLOYEES, THE INSTITUTE OFFERS:

• **On-the-job training** service to assist companies in establishing effective programs.

• **Training of key production** and maintenance employees to help them keep up with technological advances.

• **Retirement planning,** a series of conferences to help older employees prepare for retirement.

HEI tailors its programs to fit the client's needs. Its courses are voluntary and taken on the employee's time at HEI facilities in Cleveland, Warren-Niles, Ohio, Canton-Massillon, Ohio, or Gadsden, Ala. A fifth center is being built in Chicago. Instructors and discussion leaders are selected from the clients' managerial ranks, and they are trained by HEI. The institute limits classes (15 to 18 students) and makes maximum use of visual and other teaching aids.

The company, not the employee, pays the cost of the courses and other services. HEI budgets on the basis of $100 per man for 30 weeks' training.

Republic currently has 2100 hourly and 425 management people taking the institute's courses, 30 per cent more than a year ago.

ress will dry up. Profit is a necessary element of the cost of all products.

The techniques of communications depend on your situation, yet certain tenets must be followed no matter who you are:

1. Be truthful and credible. If you make an error, acknowledge it quickly. If your claims are true but challenged, support your position with facts.

2. Talk up, not down, to your employees.

3. Communicate continually. The crash program may crash for a total loss.

4. Make your communications two-way by being as direct as possible. The face-to-face approach is best. Caterpillar Tractor Co., Peoria, Ill., gives this advice to make better communicators of its managers, from the foreman on up: Listen to your people; ask for their suggestions; tell them what's going on; tell them how they're doing.

Communications budgets vary widely in metalworking. The minimum is $1 per employee per year, excluding salaries for public relations people and similar specialists whose primary job is communicating. Like GE's, your program can go all the way, with plant newspapers, news letters, bulletin board displays, letters sent to the employee's home, educational courses. Or you can follow the route of American Motors Corp., another company with successful communications. It has no plant papers, no regular news letters, no courses on economic understanding. It does send letters to the homes from to time, but emphasizes personal, direct communications—from George Romney on down. For example, AMC rented Milwaukee County Stadium last Labor Day so Mr. Romney could talk to Milwaukee employees and their families. The company also emphasizes quality with booklets and plant slogans.

The second spark to give life to your program for revitalizing people power is motivation. Good communications motivate people if the appeal is to sensitive areas. Mr. Rucker says people like:

1. Association with important people. They want occasional contact with the company president and other top officials.

2. Association with important events. They want a feeling of belonging.

3. Predictability, rather than security. They want a hand in events that will affect their destiny.

4. Recognition and use of mental as well as physical abilities. That's the motivation most frequently overlooked.

5. Money. They want it, of course, but it's often not the most important need.

If you have goals, a program to achieve the goals, and means of communicating to motivate people, you are well on the way to leadership. That's the third spark needed in revitalizing your people power.

Burroughs Corp., Detroit, says leadership involves professionalism; mental and physical energy; emotional stability; an instinct for human relations; enthusiasm; persistence; and the ability to plan, delegate, analyze, seek and use advice, make decisions, control and win co-operation.

You can describe how to get leadership and what it is—up to a point. Indescribable is the magic of winning hitherto unmatched performance out of people working individually and together. Then you get a synergistic effect—two plus two equals five, or more.

We've examined the principles that apply basically to more effective use of human resources. Yet jobs and people differ. Let's look at special approaches needed in three areas—in management, in nonsupervisory whitecollar levels, and in hourly positions—to see how to best improve the individual and team performance in revitalizing people power.

Efficiency Starts at the Top

Top management's duties are twofold, points out Arch Patton, director, McKinsey & Co., New York: 1. To manage the company well—it must make a profit. 2. To make it grow.

"To carry out the first," says Mr. Patton, "the manager makes and interprets the philosophies and objectives of the company and manages people. To achieve the second, he makes his company grow through expansion, acquisition, or merger."

● **Set Goals**—To do either job, planning can't begin until goals are set. Don G. Mitchell, president, General Telephone & Electronics Corp., suggests a company have three:

1. "A short term goal—say 12 months. This is represented by the annual budget and shows you month by month where you are going—by division, by department, by section.

2. "A reasonably long term goal—say five years. It's important that this goal is revised and updated each year.

3. "A dream goal—a big, long range target to shoot for. (The one you don't tell the boys about.) You have great plans if you want to get anywhere. Maybe you can't make it, but it's worth trying."

Company goals should be projected downward through each function to the department and foreman level. And you can't describe goals in platitudes about volume and profits—clear, crisp statements of end results for every function of the business are required. Some goals can be defined with numbers to state sales, manufacturing, and cost objectives. Others can only be defined with words, carefully chosen to reflect exactly what the function or activity is to achieve.

● **Fix Individual Targets**—Setting manager targets relating to company goals provides the base from which to first measure and then improve efficiency. M. P. McNair Jr., manager, organizational development services, American Radiator & Standard Sanitary Corp., suggested these guideposts at last

Give Your People Incentive

Allen W. Rucker

ABOUT 1.9 million metalworking employees work under incentive payment systems. They cover a wide range, including a piecework plan, commissions on sales, bonuses for work beyond a given standard.

Management reaction to incentives runs from the rhapsodic to the sour. The company that is down on them usually suffers from "runaway incentives"—those that are no longer realistic or up to date. All experts agree that incentives are no panacea and require constant attention if they are to work.

In fact, the inventor of a plant-wide, teamwork incentive program, Allen W. Rucker of Eddy-Rucker-Nickels Co., Cambridge, Mass., is careful to warn his clients that his plan will be successful only if the management is also good. About 170 plants (here and abroad) use his plan. Examples of results:

- An Eastern manufacturer of custom-built machinery raised plant-wide productivity 16.5 per cent above standard. In the first year, incentive earnings of direct and indirect labor averaged $660 above regular pay. The company added $1144 per employee to its gross operating margin after paying the incentive.
- A maker of fabricated metal products raised its plant-wide productivity 27 per cent above standard, paid incentive earnings to all labor averaging 44 cents per hour, and increased its gross operating margin $748,112 in a 12 month period.

"Our approach," says Mr. Rucker, "stimulates employee co-operation by eliminating the mystery of how wages are related to what a company receives in return for a dollar of pay or an hour of work."

The plan can be applied to all employees or certain groups like the hourly workers. Some companies cover

fall's National Industrial Conference Board meeting in Pittsburgh:

1. The superior's targets must be drafted before the subordinates'. They provide a central goal to which all subordinate results contribute. The superior's targets are not just a collection of subordinate targets; they are the synthesis, the whole.

2. Targets must define specific results, not activities. You don't "set up a cost cutting program," you "cut operating expenses 5 per cent." You don't "increase marketing effectiveness," you "boost your share of the market from 16 to 19 per cent." You don't "increase management replacement strength," you have "at least two qualified replacements for each department head by yearend."

3. Targets must be inclusive of entire responsibility and establish definite, forward looking goals in each major area of activity. There's always the danger of concentration on one phase to the detriment of another. For example, a division head with only a profit-as-a-percentage-of-sales target could hit the bull's-eye but let inventories and receivables get out of hand.

4. Targets should tie directly into the business planning and budgeting process.

5. Targets should be realistic. They should require high level managerial effort but should not be impossible.

6. Targets must be harmonious within any one component and between components. You must crosscheck targets. Are marketing, manufacturing, and engineering all aimed in the same direction supporting the over-all company goals?

● **Pick the Right Managers**—Says a McKinsey director, Ewing W. Reilley: "We fall down in selecting the right man if we don't ask: What does he have to do? What does he have to know? What does he have to be?"

Warns Mr. Reilley: "Don't put a good intuitive operator in a basic planning function. Don't promote a good man above his abilities."

● **Blueprint the Job**—The right goals and people are still not enough. The scope of the manager's job, how it fits into the organization, and his accountability for an identifiable end result have to be understood if he is to do his job well. Many a slipshod performance can be traced to a poor or hazily understood job description.

The job description and accountability for specific results can be one of the most powerful influences available to top management to get the best results from its managers at all levels, says Dale Purves, managing partner of Edward N. Hay & Associates Inc., Philadelphia. "Accountabilities in his job—and how they relate to other jobs and to organizational accomplishment as a whole—will mo-

all employees but have separate plans for hourly and salaried people. Some multiplant companies apply the Rucker Plan as an executive incentive only.

The "team" productivity gain is measured regularly (usually monthly) in a single money figure. The earned "team" incentive is distributed to individuals pro rata on the regular earnings (including overtime) of each person—one basic computation for each period. The "team" productivity gain is the money value of higher employee-team output, along with cost reduction resulting from savings in materials, power, re-do, and rejects. The team receives a definite percentage of the money gain, and so does the company.

The plan is based on the statistically proved fact that production value added by manufacture per $1 of regular wages is a near constant—$2.54 in the case of all U. S. manufacturing. Labor's share of the value added for all U. S. manufacturing is consistently 39.4 per cent; management's is 60.6 per cent. The dollar figures and percentages vary for the individual industry and the company.

When installing a plan, the Rucker people audit the company's business to arrive at the dollar and percentage figures. Suppose that $3.278 is added in value per $1 of wages, as shown by company records over the years. It means that employees' share is 30.51 per cent and management's 69.49 per cent.

Here's how Rucker results might look for one period:

Total regular payroll	$110,192
Standard value added by manufacture	361,166
Actual value added by manufacture	408,227
Gain from standard	47,061
Employees' share (at 30.51 per cent)	14,358
Management's share (at 69.49 per cent)	32,703

As part of the plan, a committee is formed to promote joint co-operation in the program and a continuous flow of suggestions from employees for improvement in the value added by manufacture.

Example of suggestions: Two months after a Rucker Plan had been installed in a plant making packaging machinery, a machinist asked what four holes he had been drilling were used for. Nobody knew. A detective job revealed that the design had been changed nine years before, making the holes no longer necessary. That change had been overlooked in the new drawings and blueprints. The machinist had been drilling four needless holes for nine years.

A Rucker Plan payoff to employee participants typically ranges between 12 to 15 per cent a year. In booms with price increases, the share could rise to 30 per cent, and in recessions with marked price declines, it could drop to 3-5 per cent.

"The plan rarely fails," says Mr. Rucker, "but the people who run it sometimes do."

tivate him far more than any amount of kid-glove human relations."

How can a man do a good job if he doesn't see what his real job is and how it makes an important contribution toward achievement of organization goals? And how can the man be developed in any realistic sense without knowing the things which are revealed to him by understanding his accountability?

- **Maintain Climate**—Is the environment in which managers operate sufficiently free and challenging to stimulate creative thinking and broad planning? Both are key factors to manager efficiency. Top management gives an organization its character and push toward goals. If there's confusion and bickering and frustration at the top, you'll also find it—probably magnified—at lower levels.

Delegate the authority and responsibility that each level of management needs to carry out its goals and targets. Says General Telephone's Mr. Mitchell: "Delegate authority and accountability so that every decision is made at the lowest level where that decision can be intelligently made."

Hand in hand with delegation is the freedom to make a mistake and even fail. Unless managers have the freedom and authority to reach goals by their own methods, productivity will suffer.

- **Measure Managers**—If you're going to reach any goal, you have to have check points along the road. The biggest pitfall is that all too often lower echelon managers are unwilling to pass bad news up the line. The result can be a problem that's not recognized until the roof caves in.

The best way to see that goals are being carried out is to measure a manager's performance against what he's supposed to do—factors he's accountable for, his targets, and how they relate to corporate goals.

AMA's Lawrence Appley suggests two factors to consider: 1. How the manager interprets and fixes the goals for his organization. 2. The methods he uses to achieve them (attainment of a goal is useless if the business has been milked to do it).

Think out your measurement techniques. McKinsey's Mr. Patton warns that a subjective management appraisal too often results in judging a man by what is thought of him rather than by what he does. Equally misleading may be the straight mathematical technique of judging performance in terms of individual targets unless it takes into account the difficulty of accomplishment. The best method: A combination of the two, says Mr. Patton. Performance is judged in terms of agreed upon tasks reflecting the goals of the business.

Bell & Howell Co. combines control, measurement, and incentives at departmental levels. Each

Robert E. Vivian

The Six Keys to Effective Communication

ROBERT E. VIVIAN, editorial and research director, Employers' Labor Relations Information Committee, New York, says these six elements must be present if an employee communication program is to succeed . . .

1. PARTICIPATION

Top management must personally participate in mapping objectives and policies. And there must be company-wide awareness of their involvement. Otherwise, the effort will be sterile and meaningless.

2. TALENT

The least expensive thing that management can buy is talent. Lack of talent has been the downfall of many corporate communication efforts.

3. INDIVIDUALISM

Objectives and views must be stated in terms that penetrate the individual's emotional consciousness. You must communicate in terms of mutuality—you and your job, you and your pocketbook, you and this plant, you and this company.

4. COURAGE

Never duck the controversial or difficult. Often, that's where interest is highest. Without courage, corporate communication lapses into sweetness-and-light goo that influences few.

5. CREDIBILITY

Demonstrate that frank integrity governs relationships with employees. The mind and heart have both insight and understanding, and from them comes almost unerring perceptiveness.

6. CONTINUITY

Let communications have no time limits. Provide adequate facilities for listening to and measuring response. The most gifted "special" communication, the most persuasive argument wilts and crumples if the normal climate is one of isolation and nonsharing by management.

year, performance goals are based on the previous ten months' performance of both the department and average of all departments in a specific program. Performance is broken down into specific areas of activity:

1. In manufacturing, a supervisor gets a production schedule from Bell & Howell's production control department. Performance is measured as a ratio of "earned hours produced" to "hours scheduled."

2. Budget performance is broken into three factors—indirect labor, supplies, and spoilage.

3. A methods improvement factor is based on the annual savings generated by both supervisory and employee suggestions. Ratings are tailored to the department and activity. Experience has shown that it's easier to make improvements in some activities than others. Example: Improvements in part manufacturing are generally easier to come by than in assembly.

4. Housekeeping is another factor and is the responsibility of the superintendent at Bell & Howell.

5. Safety counts too. Primarily, each department is evaluated against a checklist of safe practices.

Such factors are weighted and the supervisor's incentive is determined by a point system which reflects his performance against the goals and targets.

Higher up the management level it often becomes more difficult to break down a manager's job into measurable components. But it can be done, even though the degree may vary. For example: Research and development have always been considered tough to measure. (The same goes for the efficiency of the R&D manager and his personnel.)

The Association of Consulting Management Engineers Inc., New York, cites these guideposts for getting the job done:

1. Determine the purpose of the over-all function and individual projects. Is it to find a new product, cut costs on a manufacturing process, or add a gadget for sales appeal?

2. Distinguish between direct output and indirect results. Getting the job done often doesn't go far enough. More objectivity can be injected if the

manager compares performance with that of competitors. Indirect results of research can be measured by cost savings achieved because of product or process improvements or profits realized on new products.

● **Motivate the Manager**—Mr. Appley suggests two major areas to consider in motivation.

First is the climate the organization operates in. Does the company recognize management as a specific activity? Are responsibility and authority centralized or decentralized (the more leeway, the better)? Are mistakes tolerated? Does company philosophy recognize its obligations to employees, stockholders, consumers, venders, and the government? Is there job challenge?

A bad climate is created by instructions, by edict, the slogan manager, the one man decision maker, the busybody—the manager who thinks "busyness" is an indication of productivity, the man with little faith in his subordinates.

Second is incentive compensation. Managers must be paid in relation to their productivity. There are many ways to do this: Pensions, bonuses, profit sharing, stock options, deferred compensation.

Mr. Mitchell explains one of the programs at Sylvania this way: "Under the Sylvania Executive Incentive Compensation Plan, if the company makes 8 to 13 per cent on investment, for each percentage point beyond 8 per cent you get 2 per cent of your salary as a bonus. If the company makes over 13 per cent, for each additional percentage point, you get 3 per cent of your salary as a bonus, plus 10 per cent. Now if you figure this up, you'll see that at 26 per cent, you'll get 50 per cent of your salary as a bonus. That's something for the boys to work for!"

"A major incentive," says McKinsey's Mr. Patton, "is the opportunity for promotion—in function as well as title. This is one reason why a manager should want his firm to grow as rapidly as possible."

● **It's Up to You**—Efficiency is pretty much up to you once top management has set up the over-all company goals, the organization and incentive to relate your job to those goals, and the control and measurement of your area of accountability.

Look at the basic shortcomings STEEL found (Page 93) and see how you can improve your effectiveness.

Do you really need all those people? Are you practicing for them what you want top management to do for you—delegate responsibility and authority and let them do it their way instead of yours? It's a fact that if you give a man 6 hours of work to do he'll soon be able to stretch it to 8 hours so that he looks busy. (He actually will be because he'll be doing it the inefficient way.)

Why don't junior managers put into practice the fine management ideas and new techniques they have learned in school and the courses you send them to?

Probably because you're not giving them the green light.

Of course, there are right and wrong ways of

PEOPLE POWER

Ten Pillars of Economic Wisdom

WHAT FACTS should you communicate to your people? American Economic Foundation suggests concentration on these:

1. Nothing in our material world can come from nowhere or go nowhere, nor can it be free; everything in our economic life has a source, a destination, and a cost that must be paid.

2. Government is never a source of goods. Everything produced is produced by the people, and everything that government gives to the people it must first take from the people.

3. The only valuable money that government has to spend is that money taxed or borrowed out of the people's earnings. When government decides to spend more than it has thus received, that extra unearned money is created out of thin air, through the banks, and, when spent, takes on value only by reducing the value of all money, savings, and insurance.

4. In our modern exchange economy, all payrolls and employment come from customers, and the only worthwhile job security is customer security; if there are no customers, there can be no payrolls and no jobs.

5. Customer security can be achieved by the worker only when the "boss" is allowed, by the worker, to do the things that win and hold customers. Job security, therefore, is a partnership problem that can be solved only in a spirit of mutual understanding.

6. Because wages are the principal cost of everything, widespread wage increases, without corresponding increases in production, simply increase the cost of everybody's living.

7. The greatest good for the greatest number means, in the material sense, the greatest goods for the greatest number which, in turn, means the greatest productivity per worker.

8. All productivity is based on: Natural resources whose form, place, and condition are changed by the expenditure of human energy (both muscular and mental), with the aid of tools.

9. Tools can increase only when there is a reward for the temporary self-denial that people must practice to channel part of their earnings away from purchases that produce immediate comfort and pleasure and into tools of production. Proper payment for the use of tools is essential to their creation.

10. The productivity of the tools—that is, the efficiency of the human energy applied in connection with their use—is highest in a competitive society in which the economic decisions are made by millions of progress seeking individuals rather than in a state planned society in which those decisions are made by a handful of all powerful people, regardless of how well meaning, unselfish, sincere, and intelligent those people may be.

"Anything not concerned with supervising people is not management"

LAWRENCE A. APPLEY
President, American Management Association

WHAT constitutes the greatest drain on management productivity? To find the answer STEEL went to Lawrence A. Appley, president of the American Management Association—a man who pioneered many of the management practices now accepted as standards. He made this point:

"The greatest wastes in a manager's productivity are the result of demands upon his time for nonmanagement activities. Anything not concerned with supervising people is not management. One of the greatest tragedies is when a manager's own people can't get to see him because of his involvement in other matters.

"Managing people is a five pronged activity:

"1. Decide what you want them to do.
"2. Select qualified people to do it.
"3. Prepare them to do it.
"4. Check how well they are doing it.
"5. Find ways and means of their doing it better."

What can we do to release the manager so he can devote all his time to the five supervisory functions?

Suggests Mr. Appley:

"First divide the manager's job into two distinct parts: 1. Management functions. 2. Operating functions.

"Second, get people without management ability to perform the operating functions. The greatest asset for any executive is a competent 'assistant to' who can screen the trivia, analyze reports, keep records, handle details."

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doing things. But there are also different right ways.

• **Face the Issues**—Listen to R. D. Robertson, vice president-manufacturing, Norma-Hoffman Bearings Corp., Stamford, Conn.: "A major stumbling block to greater productivity is the unwillingness of managers to face distasteful situations. Leadership entails responsibilities as well as privileges. Too often the man at the top will run for the hills when something nasty comes up, so he can stay a 'nice guy.'

"Avoiding decisions loses the loyalty and services of the 'doers.' It makes lower line managers afraid to do their jobs.

"We must create an atmosphere where a man can carry out his duties without the fear of incurring someone's displeasure."

• **Establish Your Successor**—That's also up to you. Failure to establish replacements in management has been a problem for generations. It's always costly. It could be fatal.

• **Prod Productivity**—Marginal performance won't be enough in the competitive sixties. You will need:

• Sharper Craftsmen: Step up training of managers in the skills of managing.

• Sharper Performance: Demand more of people. The best managers are the most demanding.

• Sharper Communications: "Communications, particularly upward, suffer from serious deficiencies," says Dr. Rensis Likert, director, Institute for Social Research, University of Michigan. "Our research findings indicate the manager and his subordinate often don't see the subordinate's job the same way—in terms of performance, standards, and goals. If middle and upper management aren't getting the right information, they often don't know about a problem until it explodes in their faces."

• Sharper Teamwork: Today's metalworking market is too complex for one man alone. Build competent staffs that can investigate alternatives, make recommendations, advise on decisions (there's nothing wrong with committees—only in the way they are used). "Remember," says Dr. Likert, "a decision doesn't determine the result. The result is the decision times the motivation to carry it out. A group will fight harder to carry the decision out."

Make Asset, Not Liability, of Whitecollar Army

Too many people producing too little work?

If that's your problem, what are you going to do about it? How are you going to get better performance from staff employees—the whitecollar nonsupervisory people who account for 18 per cent of metalworking's employment?

By motivating them, of course. But how can you motivate this mixed assortment of messengers, receptionists, clerks, typists, stenographers, draftsmen, buyers, accountants, designers, scientists, and engineers?

Basically, there are two ways: 1. By more effective human relations. 2. By applying "science"—industrial engineering and mechanization. Both must be used concurrently, the former to implement the latter.

• **Improve Human Relations**—Starting with human relations, you can accomplish your objectives:

• By setting a good example. Be a conspicuous hard worker yourself and let supervisors know: "You'll have to stay on the ball if you're going to be a member of my team."

• By improving communications. Give supervisors and staff people all the information they need—before they get it from the newspapers or by the grapevine. Let them know how their company is doing, where it's going, and why they're important to its success. Communicate in person as often as you can.

• By hiring better people and training them more thoroughly.

• By satisfying their basic needs for:

1. Identification with the company (feeling of "belonging" and participating in its progress).
2. Status and recognition.
3. Security.
4. Material rewards.
5. Opportunity to advance.

• **Help Your Supervisors**—Since supervisors have first line responsibility for motivating staff workers, it's most important that you select them carefully. Industrial relations experts recommend that you pick them on the basis of tests (intelligence, skills, psychological orientation), job knowledge, and performance in "group oral" discussions (where you can appraise their leadership potential). Pitfall: Avoid selecting a man simply because he's a politician or has the most seniority.

Once you've selected your supervisor, you've got to train him. The industrial relations vice president of a leading metals producer put it succinctly when he told a recent STEEL roundtable: "We fall flat on our faces when it comes to supervising the needs of the supervisor. We should bring them together in groups of four or five and ask: 'What can we do for you?' 'What do you need to know?' "

They need to know more about human relations and about organizing, delegating, planning, and co-ordinating work. They need to know exactly what their responsibilities are—where they have jurisdiction and where they don't. They need your understanding and support.

• **Hire Better People**—Chances are that few of your staff employees are working at more than 65 per cent of capacity. Tests at other companies have shown that efficiency in some departments is as low as 30 per cent because of a faulty system (insufficient workload), poor supervision, substandard clerical help, or all three.

If the staff people themselves are at fault, you'll understand the need for raising your hiring standards. In the future, you'll try to find people who are "service oriented"—who find satisfaction in providing others with fast, efficient, quality service. (Some people are temperamentally unsuited for such jobs; they resent serving others because it makes them feel inferior.) You'll test for skills. You may have to hike your starting salaries to get people with more intelligence, better education, and greater adaptability, but you'll be money ahead in the long run.

A word of caution: Don't overhire. If you put a smart fellow in a dull, repetitive job, he's going to get frustrated, and he'll be articulate enough to make the people around him unhappy too.

As you acquire better people, you can rid your organization of the misfits. Some will leave via attrition. Others will have to be dismissed—perhaps during recessions, when staff reductions are often mandatory. Side benefit: People who aren't fired will be motivated by the knowledge that you thought enough of them to keep them.

• **Train Staffers Better**—If you can get better raw material, you'll undoubtedly want to develop it to full potential. You can do it by upgrading your training methods. Start with thorough orientation. See to it that your staff people hear from top management, as well as immediate supervisors. Give

weekly instruction in company-wide procedures, plus on-the-job training. Broaden skills by teaching staff people to operate several types of machines and do a variety of jobs. Benefits:

1. You'll be able to move them from one department to another to meet peak workloads.

2. You won't be stymied by the resignation, vacation, absenteeism, or illness of "the only one who knows how to do it."

In dealing with older employees, try to improve their skills through courses in such things as reading, typing, shorthand, and keypunch operation. At periodic merit review sessions with them, discuss their strengths and weaknesses and find out what they propose to do about shortcomings.

Above all, tell employees—new and old—what you expect of them. If you let them set their own work pace, you'll be lucky to get 65 per cent efficiency.

• **Satisfy Basic Needs**—Although there are many types of people in the nonsupervisory whitecollar category, they all have the same basic needs—but in varying degrees. They want to be able to identify themselves with their employer. They want security, competent supervision, friendly associates, a feeling of importance, fair pay, fair treatment, and a chance to get ahead.

You can satisfy their need to "belong" through better communications. As one industrial relations expert told STEEL: "People work best for me when I treat them as human beings and when they think they know everything I know. We've got to get away from the historical concept that everything in business is top secret."

Encourage staff employees to tell you how the job can be done better. Reward them for good suggestions in the knowledge that recognition will probably mean more to them than money.

To find out what they're thinking and to spotlight possible deficiencies in your programs, you might use attitude surveys. You could conduct one yourself. The Employers Association of Detroit has developed a 16 page audit of pay practices, attitudes, general personnel practices, and working conditions. For details, write to SALARY AUDIT, Employers Association of Detroit, 3845 W. Eight Mile Rd., Detroit 21, Mich.

If you want an outside agency to do a survey for you, get in touch with the Industrial Relations Center, University of Chicago, Chicago 37, Ill.

Surveys are often beneficial, but they can backfire unless you:

1. Announce the results.

2. Follow through on criticisms that have merit —correcting conditions that are adversely affecting morale.

• **Special Needs of Professionals**—Although pay is one of the principal motivators for most whitecollar workers, it's relatively less important to engineers and scientists. Their main concerns are achievement, recognition, and desire for advancement. Lee E. Danielson, professor of industrial relations, University of Michigan, says you can expect them to find satisfaction if they:

- Can complete a task that yields a visible result in which they can take pride.
- Can feel they are creating something which requires imagination and ingenuity.
- Are faced with a challenge that they feel can be met if they extend themselves.
- Have a purposeful variety of job assignments which may include some related routine functions.
- Are able to contact others within or outside the company with whom they can share ideas and gain personal recognition.
- Have the support and trust of the supervisor, as evidenced by direction commensurate with ability.

Even when they're not serving in supervisory capacities, engineers and scientists want to be treated as respected members of the management team. They want "individualized" supervision.

Since they become highly involved in their work, they react strongly to obstacles that prevent the successful completion of a project. They tend to regard managers as limiting factors. That's why you should make a special effort to explain to them the rationale of your decisions and actions.

Since most of the scientists think they have to get into administrative positions to advance and increase their earnings, you may have trouble keeping good basic research men in technical work. To minimize turnover, Professor Danielson recommends that you consider the advantages of dual promotional channels—administrative and technical.

• **"Creative Interaction"**—To motivate your engineers to produce something extra special, try "creative interaction" sometime. Assign two engineers to the same project. Have them work separately, but let each know that he has a competitor. Explain that when the deadline comes, you'll summon both men to a conference and that they'll present their solutions to a panel consisting of such "brass" as the engineering manager, division manager, and vice presidents of sales and manufacturing. Each engineer will show his design concept, tell how it works, and explain its advantages and shortcomings. The better design will be adopted.

In actuality, your solution will probably be a compromise—not to keep both men happy but to incorporate the best features of both designs.

Double teaming is admittedly costly, but it may pay big dividends. It has been used with great success by a large Midwestern manufacturer of machinery components. It's worth while when you're planning a major project—such as a new product —that will require top management decisions and heavy capital investment.

"Labor relations . . . the place where management most often flops"

EDGAR F. KAISER
President, Kaiser Industries Corp.

"LABOR RELATIONS is one of the most important areas of management and yet the place where management most often flops," believes Edgar F. Kaiser, president of Kaiser Industries Corp.

"Good labor relations is simply a matter of human relations," believes Mr. Kaiser. "The key: Confidence and understanding between both parties. This means good management on both sides. Particularly important from the company's standpoint is that middle and first line management realize this fact since they're the ones who have day-to-day contact with the work force."

Mr. Kaiser amplifies: Too many managers feel once the contract is signed, that ends things. It doesn't! Labor relations is a 365-day-a-year job. The reason so many grievances eventually have to be settled by top management is the failure of lower management to realize this fact.

"A key management challenge," emphasizes Mr. Kaiser, "is to develop some procedure that eliminates the frictions and the type of contract deadline that permits strikes." Last year, such problems led Kaiser and the United Steelworkers of America to set up a Long Range Committee and a Work Rules Committee to see if some type of progressive labor-management formula could be hammered out.

Are the committees working?

Says Mr. Kaiser: "We are now seriously talking over problems that couldn't even be discussed while negotiations were underway. We're talking about how the workers can help cut costs and then share in the fruits of these savings.

"Where work rules are concerned, success depends entirely on the confidence that exists between both parties on the local level. When people understand the issues, you can usually get a pretty fair response. Achieving this understanding is management's job."

• **Apply Industrial Engineering**—To supplement your human relations attack on waste and inefficiency, you'll want to use "science"—industrial engineering and mechanization.

As a starter, study all staff functions, applying the techniques of work simplification and work flow analysis. Objectives:

1. Remove bottlenecks and avoid backtracking.
2. Co-ordinate departments to eliminate duplication of clerical routines.

Then ask yourself these questions:

• Do we really need all those reports? Do we need them so frequently?

• Are we setting unrealistic deadlines for reports and forcing overstaffing to handle peak workloads?

"The art of issuing complex reports on anything and everything stifles productivity," says Charles Passman, Profit Counselors Inc., New York consulting firm. "And it also unnecessarily increases the number of clerical workers needed."

• **Measure the Work**—The next step is to find out how much work individual whitecollar employees and departments are doing. You can do it by time and motion studies or by using experience for measuring group production. It's generally best to develop your own standards, but you may be able to use predetermined time values developed by the U. S. Navy Bureau of Supplies & Accounts.

Proponents of work measurement in the office say the typical clerical worker's productivity can be

12 Ways to Increase Whitecollar Efficiency

1. HIRE BETTER PEOPLE
Raise your standards and be more selective. Hire "service oriented" people. Require more education, higher intelligence, greater adaptability. Test for skills.

2. IMPROVE TRAINING
Prepare job descriptions and make sure each employee knows exactly what is expected of him. Use on-the-job coaching and classroom instruction. Issue manuals.

3. BROADEN SKILLS
Teach officeworkers how to operate several machines and do a variety of jobs. Make it easier to transfer them from one department to another to meet peak workloads.

4. UPGRADE SUPERVISION
Select supervisors carefully (through tests of supervisory ability) and train them well. Give them full support—operating manuals, help from outside consultants. Make sure they're free to *supervise.* It's a full time job.

5. IMPROVE ATTITUDES
Find out through supervisors or surveys how employees feel about their work, compensation, supervision, and personal satisfactions. Correct adverse conditions.

6. MEASURE THE WORK
Simplify it first. Then measure, set standards, and keep score. Find out what a "good" day's work is—how many people a department needs to do one. Move surplus workers to understaffed departments.

7. PROVIDE INCENTIVES
On jobs that can be measured, give extra pay for better-than-standard performance. On others, give merit raises. Emphasize opportunities for promotion.

8. REDUCE PAPERWORK
Eliminate useless paperwork. Analyze reports to see whether they reflect a need or a whim. Are they needed so frequently? Are some obsolete? Can some be combined?

9. IMPROVE ENVIRONMENT
Make the office a more attractive, efficient place to work. Check conditions that may affect morale: Space, lighting, equipment, noise, restroom and dining facilities.

10. CO-ORDINATE DEPARTMENTS
Eliminate splintering of related paperwork activities. Prevent duplication of clerical routines. Stop departments from thinking only of limited, departmental objectives. Keep company-wide goals foremost.

11. IMPROVE SYSTEMS
Analyze work flow to remove bottlenecks and avoid backtracking.

12. INCREASE MECHANIZATION
Let machines do the drudgery, so that you can upgrade clerical jobs. Use computers for routine, repetitive operations. Use integrated data processing equipment to tie order entry, sales analysis, and inventory control into one semiautomatic operation.

increased by as much as 60 per cent by setting standards. What's more, they assert, standards can be set for 80 to 85 per cent of the repetitive, clerical operations.

There are only two general types of work that fall outside the scope of measurement:

1. Jobs that are primarily creative.

2. Jobs that require an employee to be stationed somewhere regardless of work volume. Example: A receptionist's job.

Since whitecollar employees consider themselves to be on a higher plane than factory workers, they may not be flattered by your work measurement studies. To sell them, you'll have to explain that what you're doing will increase departmental efficiency and that no one will be laid off as a result —though some may be transferred to departments where they're needed more.

For maximum effectiveness, work measurement must have:

1. Full support of top management.

2. Supervisors who are prepared to administer the program and use the results.

3. Employee understanding of the program.

4. Sufficient volume to justify the setting of standards for any single operation. (If you have less than ten clerical people, chances are the cost of the program even based on predetermined data would exceed the anticipated savings).

But if conditions are right, the benefits can be enormous (see exhibit, Page 131).

• **Establish Incentives**—"Just by measuring the work, you can boost clerical output by 20 points —from 65 per cent efficiency to 85," says W. Gilbert Brooks, chief time study engineer, Pitney-Bowes

Inc., Stamford, Conn. "But to get the cream," he continues, "you must install an incentive system."

Pitney-Bowes has had one since 1948. Explaining how it has worked out in the firm's transcribing section, Mr. Brooks comments: "The section originally had 15 employees. Since the installation of incentives, the workload has been increased by about 35 per cent, but the staff has been cut to 11. Net savings after deducting the cost of installation, maintenance, timekeeping, and incentive earnings are about $30,000 per year. Individual productivity is up 45 per cent, and employees' average weekly earnings have increased 34 per cent—not including normal pay raises and general salary increases."

Incentives have since been set up in many other departments by employee demand. The company figures that total savings are running $150,000 to $170,000 a year.

In addition to helping you reduce the size of a staff, incentives can help you power up so that you can take on more work without taking on more people.

To qualify for an incentive system, an office group should be fairly large and homogeneous. Its work should be fairly repetitive and routine. Its supervisor should be receptive to the idea.

• **Increase Mechanization**—As a final step toward increasing the effectiveness of whitecollar employees, you'll want to provide them with the latest equipment—not just computers but integrated data processing equipment, tabulating equipment, accounting machines, dictating equipment, and copying machines. If you don't reduce office employment, you'll at least prevent it from growing. You'll get more power from people who are currently on the payroll.

Power Up with Hourly People

"Good labor relations are almost always paired with high worker efficiency," says Prof. E. Robert Livernash of Harvard's School of Business. He's a co-author of *The Impact of Collective Bargaining on Management*, just published by Brookings Institution.

His observation holds whether or not your plant is organized. Whatever your company's union situation, the route to good labor relations and high worker productivity is: Set goals, have a plan to achieve them, pick people to carry them out, and make the whole program work with the catalytic agents of good leadership, the right motivations, and thorough, honest communications.

• **Communicate**—Communications are important at all levels of your company, yet they are especially needed among hourly workers who are farthest away from managerial concepts.

"The quickest way your workers become upset is if they get the idea you don't know where you're going," says E. L. Cushman, vice president of American Motors Corp. "That's why communications are essential."

"Of course, you have to have a good case," says Donald C. Duvall, executive vice president of Pitts-

PEOPLE POWER

Work Measurement in the Office

Clerical work standards are being used with increasing frequency to reduce and control costs. They can help you . . .

• STABILIZE OFFICEWORK

By relating standards realistically to workload, you can anticipate and schedule peaks and valleys, eliminating guesswork in staffing.

• IMPROVE METHODS

By setting up standards of performance, you can improve methods—cutting costs in methods alone by as much as 30 per cent.

• EVALUATE EQUIPMENT

Analyze equipment purchases more logically, comparing costs with those of machine and method alternatives.

• ANALYZE REPORT COSTS

Figure in advance what it will cost to prepare a report.

• CONTROL OFFICE COSTS

Budget office and clerical costs more accurately.

• EVALUATE DEPARTMENTS

Compare the efficiency of offices and departments doing the same clerical operations.

• MAKE COMPENSATION EQUITABLE

By comparing performance to standards, you can pay employees equitably. You can also use standards as the basis for an incentive plan.

• REDUCE SUPERVISION

You need fewer direct controls because standards measure clerical performance and productivity.

• EVALUATE EMPLOYEES

You can measure a worker's performance by comparing it to standards. His rating can be a guide to promotions and pay increases.

• CHANGE SYSTEMS AND PROCEDURES

You can make easier comparisons between current methods and proposed changes.

Source: Profit Counselors Inc., New York.

PEOPLE POWER

George Rogers, consultant (left), discusses the latest issue of "Management Memo" with Twin Disc's president, John H. Batten

Twin Disc Fights Economic Illiteracy

TWIN DISC Clutch Co., Racine, Wis., has developed a program to keep all employees well informed on major problems affecting its operations, and, hence, their jobs.

One phase of the effort is an organized attack against economic illiteracy. The company is educating its employees—supervisors, production workers, whitecollarites—on such thorny subjects as depreciation policies, foreign competition, and inflation. The program was formulated by George J. Rogers of American Free Enterprise Productions, an employee education consulting firm.

Another effort is aimed at all supervisory and managerial personnel. It's a newsletter, *Management Memo*, released every other week by the public relations department. It covers such items as the importance of corporate growth, inventory problems, foreign operations, foreign competition, company markets, legislation being considered by government, the cost of employee benefits, and other information that helps the individual manager to broaden his scope of knowledge, and thus do a better job.

burgh Steel Co. "And then you must present it effectively."

Pittsburgh Steel did such a job and achieved lower employment costs at a time when most of the steel industry has experienced steadily climbing employment expenses. Hourly employees belonging to the United Steelworkers accepted a company proposal for a reduction in the payroll through a different method of handling incentive rates.

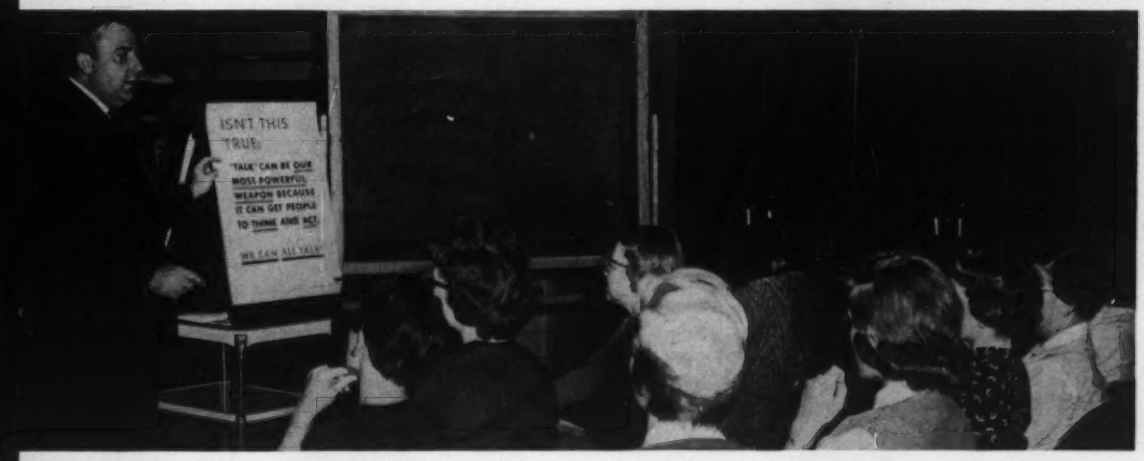
How was that done? "We started in late 1956," explains Mr. Duvall, "and used practically every communication technique—newspaper ads, letters to employees, the company publication, bus card ads, post cards, executive platform appearances, a telephone recording system, meetings with the clergy, with businessmen, and appearances on radio and television. But the highlight was our employee interview program.

"We trained two-man teams of our supervisors in details of the company's incentive situation. In slightly more than a month, those teams interviewed nearly 6000 of the 7700 in the union bargaining unit. Most visits were in the employees' homes. Interviews lasted from half an hour to 2 hours. After each interview, the team filled out IBM cards to provide a detailed appraisal of the employee's reaction. As a result, we were able to spot trends and troublespots and adjust our public communications accordingly."

Like most of the other steel companies, Pittsburgh Steel went through the Taft-Hartley injunction period in 1959 and early 1960 and into an NLRB vote on the last offer. It didn't get a majority of the votes cast, but it did record a percentage three times higher than any company had ever received in the history of T-H elections. So, its bargaining position was strong, and it was able to negotiate a special deal with the steelworkers.

Mr. Duvall and most experts agree that you need a tailored communication program, and they caution against the packaged approach. More and more are advocating General Electric Co.'s concept of using marketing methods to sell workers on the company (see how GE does it, Page 135). Pittsburgh Steel did that, essentially.

Unions interfere with the communications process. Some object to management communicating with hourly workers in all but matters of produc-



Russ Smith, assistant service manager, leads a session in Twin Disc's program of economic education for employees

John H. Batten, Twin Disc's president, explains why the program was initiated: "The active co-operation of all employees in building and strengthening the company provides a substantial competitive advantage. Through our expanded communication program, we are explaining the problems which the management of every company faces today. It is our belief that opening our employees' horizons by discussing areas not immediately germane to their own responsibilities pays good dividends. We hope to have them understand the 'why' of their job as well as the 'how' of it.

"Most employees readily recognize that the tangible things, such as quality, costs, delivery, and customer service affect customer relations and, therefore, their job security. However, not many are as aware that inflation, discriminatory taxation, shortsighted depreciation laws, and other such items are also problems.

"Our program is carefully planned to meet employees' needs for an over-all knowledge of the company's operation. With this foundation, their day-to-day personal decisions will be based on facts and not on rumors or unsupported opinions."

tion and have browbeat the managers into silence. Others insist on "communicating co-operatively."

But most labor observers are unanimous: "Communicate directly—no laws prohibit it." But they do advise working more co-operatively with unions.

Says American Motors' Mr. Cushman: "The first thing to make clear is that you think organized labor is here to stay. You also make it clear that you disagree with some of the union's philosophy and practices."

An example of unsuccessful communications with workers occurred in most of the steel industry during the 1959-60 negotiations. Steel lost the battle of work rules because the issue came to the bargaining table with poor advance introduction. The United Steelworkers twisted the matter into charges of union busting.

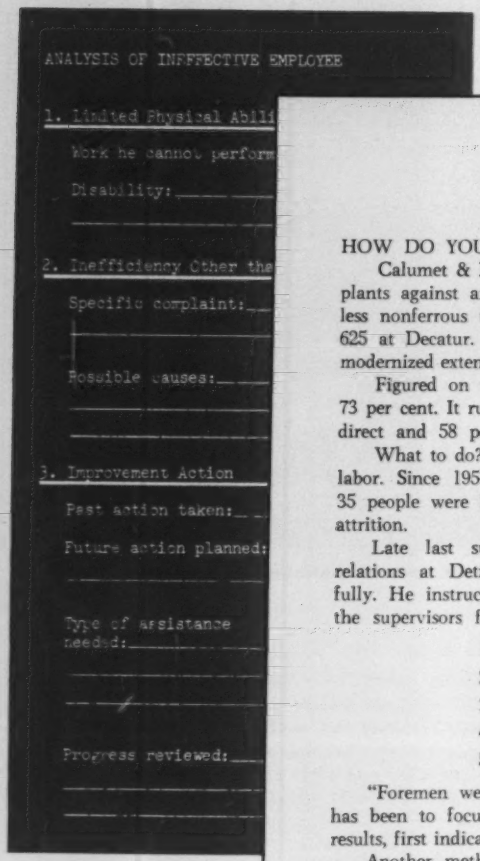
• **Win Co-operation**—Then how do you get union co-operation? "Be firm but fair," Professor Livernash told an Associated Industries of Cleveland audience last fall. "Communicate continuously," says Mr. Cushman. "Try marketing principles, rather than the crisis bargaining approaches," says GE.

AMC favors committee studies of some of the more difficult problems that need research and calm appraisal—which you can rarely get in the heated atmosphere of the bargaining table. The auto company meets from time to time with the United Auto Workers' AMC Conference to discuss company finances, economic prospects, and similar matters.

Mr. Cushman says it's vital to communicate with your top union leaders. "Union-management relations are like marital relations, even if the marriage was originally a shotgun affair," he explains.

The steel companies, as a result of contract provisions signed a year ago, are trying the committee study approach on work rules and similar problems. They have had little to report thus far. Dr. George W. Taylor, a public member and chairman of the Kaiser Steel committee, explains the problem this way: "We're engaged in a task of social inventiveness; we're trying to invent a new technique as a substitute for the strike in settling these disputes that have caused so much difficulty. When you set about to invent something, you don't put emphasis on the timing of it."

While the committee approach has promising possibilities, it should not be on too broad a basis. Mr.



The Ineffective Man

HOW DO YOU know if you're making the best use of people power?

Calumet & Hecla Inc.'s Wolverine Tube Div. does it by checking one of its plants against another. Two facilities (Detroit and Decatur, Ala.) make seamless nonferrous tubing and have comparable employment—590 at Detroit and 625 at Decatur. Decatur has the newer plant (built in 1948) but Detroit was modernized extensively in 1958. Decatur has no union; Detroit does.

Figured on the basis of standards, the best efficiency Detroit now gets is 73 per cent. It runs 75 to 80 per cent at Decatur. At Detroit, labor is 42 per cent direct and 58 per cent indirect. It runs 50-50 at the Southern plant.

What to do? Wolverine management is gradually reducing Detroit's indirect labor. Since 1954, employment has dipped 274, from 864 to 590. But only 35 people were laid off. The rest of the reduction was accomplished through attrition.

Late last summer, Robert McCoy, manager of employee and public relations at Detroit, started another program to use human resources more fully. He instructed all foremen to name their ineffective people, then asked the supervisors five questions about each person listed:

1. **What about the man is ineffective?**
2. **Why is he ineffective?**
3. **What have you done about him?**
4. **What will you do about him in the future?**
5. **Do you need help in dealing with him?**

"Foremen were nonplussed at the followup," says Mr. McCoy. "The effect has been to focus attention on the problem. Although it's too early to judge results, first indications are promising."

Another method used at Detroit to improve efficiency: Workers are kept informed via a weekly newsletter, at quarterly meetings foremen hold with their personnel, and at the two or three meetings the plant manager has with all workers each year.

Cushman believes high summit meetings like those sponsored by Labor Secretary James Mitchell are "doomed to failure because members on each side take positions designed for public relations effects, not for real study."

For that reason, Mr. Cushman (and many other labor observers) opposes a National Council of Labor-Management Advisers as advocated by Arthur J. Goldberg, secretary-designate of labor in President-elect Kennedy's cabinet.

The AMC vice president doesn't even believe that industry-wide summitry is likely to be fruitful. "The company basis is best," he thinks.

AMC has still another approach to matters of human resources. At least once a year, it discusses human resources and related issues with a panel of ten leading clergymen. It has a similar panel of educators.

A commission to study railroad work rules will begin work in the next two weeks. "We're highly optimistic about chances for success," says the industrial relations director for one of the roads. It differs from the steel committees in that it has a time limit (Dec. 1, 1961, with a three month extension if necessary), specific rules governing the agenda, and procedures for holding hearings and investigating matters. "The steel setup is too loose," says the railroad man. "We've been dealing in labor matters longer than steel has, so we're a little more experienced. But I'm glad to see that steel is at least making a stab at solving its problems. If it doesn't come up with some way to bypass these strikes, it will be as strongly controlled by the government as we are. And that leads to all kinds of inefficiencies in the use of human resources."

The drift in steel, and in autos to a lesser extent, is toward an impasse where the government may step in with legislation similar to the Railway Labor Act.

"While the situation is ominous in steel," admits Professor Livernash, "we have made tremendous progress in collective bargaining in most industries over the past quarter century. We may be frustrated at times, but we can't be too critical when we

see what's happening in the rest of the world. Europe, for example, has gone the complete legislative route, and management is much more severely limited there than here by labor laws. The U. S. is almost unique in the world in its collective bargaining approach."

• **Take the Initiative**—Mr. Livernash also warns that any gaps in the industrial relations policy that management leaves will be filled by the unions. Many labor experts point out that management today has a golden opportunity to seize the initiative which unions have held so long. Listen to one comment:

"Union membership is only 17 million now, down 1.5 million in two years. Seven of ten employees are unorganized. Labor has less than a 60 per cent chance of winning an organizational election, indicate National Labor Relations Board voting records. As recently as 1948, unions failed only 1 time in 10. The intellectual is deserting labor.

"The unions are static today in terms of growth and ideas. A company (GE), not a union or union leader, has had the greatest influence on collective bargaining in the last 15 years."

So the initiative is with you in winning good labor relations, whether or not your plant has a union. Good relations usually bring high worker efficiency. Even a prominent union president admits that it's up to you.

David J. McDonald, USW president, says: "It's my job to get more for the men. It's the companies' job to get more for their money."

• Bound reprints of the study on People Power are available at $2 a single copy; prices for larger quantities on request. Write Reprint Dept., STEEL, Penton Bldg., Cleveland 13, Ohio.

Lemuel R. Boulware

GE Takes Marketing Approach In Human Relations

GENERAL ELECTRIC CO.'s approach to human relations was born in 1947.

A bitter strike in 1946 opened management's eyes to the fact that many of its employees and neighbors didn't believe the company's intentions and practices were as good as they should and could be. Lemuel R. Boulware (now vice president) was assigned to redesign and rebuild GE's program. By adapting the tenets of consumer goods marketing to industrial relations, he and his associates developed a philosophy that is still the basis for the company's approach.

They reasoned: GE has the approval of its customers, shareholders, and interested businessmen. Why is it scoring with them and not with employees and neighbors?

They concluded: The successes stemmed from good research, product planning and selling. The failures stemmed from poor marketing.

"We found what everybody finds in product marketing," recalls Mr. Boulware. "The customer wants three things: Basic material values (efficiency, reliability, competitive price); extra human satsfaction (comfort, convenience, distinction); and assurance (of fairness). The other groups want comparable things.

"When we went to ask our employees what they wanted, they replied: '1. The material reward to come voluntarily and amount to what's right. 2. The extra human satisfactions in important work, respect for dignity, full information as to what's going on, man-to-man association with supervisors and fellow employees. 3. The assurance that the good jobs with good pay are the result of efficiency and not of any shortchanging of customers, suppliers, distribution people, owners or citizens'."

GE found what its people wanted through employee research, just as it would use marketing research to learn what customers want. Its approach to selling employees has attracted the most attention because the company speaks about controversial subjects. "But this is orthodox," claims Mr. Boulware. "We're selling our beliefs and our good conduct. If we didn't discuss the controversial, we would not be talking about what most people are interested in."

In particular, GE shows workers it's trying to give them: Good pay and other material benefits, good working conditions, good bosses, a fair chance to get ahead, steady work, respectful treatment, full information, important and significant work, and rewarding associations on the job. Its central aim: Show that GE is not one but many. For example, the company makes it clear that customers pay the taxes, the wages, and all other expenses. The owners don't pay them.

Inflation, pricing out of the market, foreign competition, technology are among the perennial questions being discussed with employees and the citizens.

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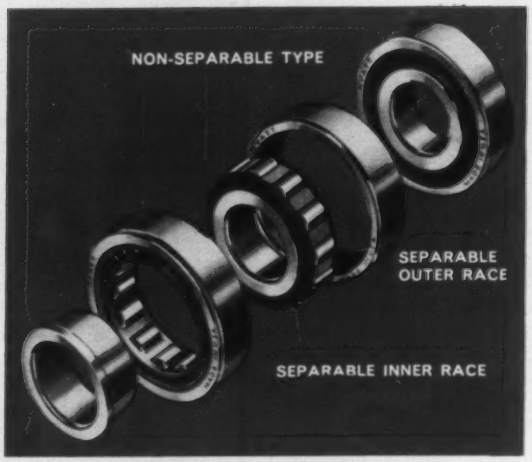

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PEOPLE POWER

Big Test Coming in Autos

The biggest show in business opens in Detroit this July as automakers attempt to win another effective labor contract from the UAW. How efficiently metalworking will be able to use its hourly people power will depend largely on the efforts of automotive bargainers. Here's how the stage is being set

BIG THREE CONTRACTS with the United Automobile Workers expire Aug. 31. American Motors Corp.'s contract runs out a week later. Studebaker-Packard's deadline is midnight, Nov. 30. The settlements will directly affect more than 1100 metalworking companies and the 1.1 million UAW members they employ.

Collectively, the companies pay these workers more than $3 million an hour. If Detroit's negotiators can't set an effective pattern, wages, costs (and eventually prices) will go up faster than productivity. Result: More inflation that will hurt the over-all economy and put a tighter squeeze on profits.

Labor Sets the Challenge

The union has already held its first round of conferences to map contract demands. Two more hearings will follow before the UAW formally ratifies its basic demands at its international convention (in Detroit during the last week of April).

Actually, the convention will rubber-stamp a program already established by UAW President Walter Reuther and his Solidarity House advisers, but the conferences give locals and splinter groups a chance to let off steam.

Gripes are trickling in now. Local 600, the giant maverick in Ford's Rouge empire, is worried about rising unemployment. It wants a shorter workweek, lower retirement age, four week vacations, limited overtime with double pay, and full term supplemental unemployment benefits (SUB). Skilled workers want more protection against upgrading people to craft jobs. They seek standardized wage scales, stiffer apprenticeships, and safeguards against combining jobs. The 100,000 skilled in the union also want curtailment of overtime and cost of living protection for retired workers.

How tough the union will make its demands may depend on what economic conditions are next spring. A stronger business climate will make Mr. Reuther anxious to ask for more. As a master politician, he'd like to win a major victory to resolidify worker support. Some ground was lost in a few key areas last year. The union was voted out at the Sikorsky Div., United Aircraft, last November because it forced its 500 members into a strike, then backed down after three months of idleness. On its increasingly important whitecollar front, the UAW failed to win bargaining rights at Chrysler's Missile Div. and AMC—Milwaukee. Its victory ratio has been less than 1 in 4, claim industry sources.

• **Demands**—From conversations with top industry and labor negotiators, it seems clear that the union will seek a 4 per cent wage increase, higher skilled pay rates, company paid insurance, more severance pay, and longer SUB. It also is hot for job security rights like transfer allowances, retraining, and termination pay.

Labor experts think Mr. Reuther is dead serious about those demands although he may make more noise about a profit sharing program, shorter work-

week at full week pay rates, and a voice in the investment of pension funds. To put more meat in its bargaining stew, the UAW will maintain a strong strike fund. Mr. Reuther says it will hit $40 million by July. It was $30.9 million last November, $3 million higher than it was in June, 1960. Net worth is up to $41 million. Average membership is 1.18 million—including about 110,000 non-dues-paying retirees.

Management Prepares Countertactics

Company bargainers will rely on negotiating tools that have proved successful in past talks.

• **Parallel Bargaining**—As in 1958, automakers will again "talk over" strategy and proposals among themselves—called parallel bargaining to differentiate it from the steel industry's joint sessions.

American Motors and Studebaker will not take part in the talks. The South Bend, Ind., automaker traditionally adopts the pattern set by the Big Three. AMC wants to bargain alone because it has a separate Kelvinator Div. contract and because it hopes to retain some advantageous work rule provisions dating back to its less successful (economic) days when the union made concessions.

AMC's philosophy is tending more and more toward the idea that there should be as few differences as possible between hourly and salaried people. It's the only automaker that has a payroll withholding program so hourly workers can buy stock in the corporation or its affiliates. It's also considering a profit sharing program that would apply to hourly and salaried workers alike.

It's unlikely that even one of the five automaking companies wants to bargain on work rules—although on the local level each will try to limit any control the unions may have in selecting repair and maintenance crews. GM's contract is tightest on this point. Chrysler's is the weakest. Management will do a lot of talking in this area, but it isn't apt to turn up in contract language.

Prof. W. H. McPherson, University of Illinois labor expert, suggests the industry may try to establish some sort of strike protection. He says: "I think we can safely forecast that the auto companies will not enter their next negotiations without some definite plans for strike assistance. They'll probably have several plans. The final selection will depend on which company is struck. The company with the latest new model introduction dates might be vulnerable."

The speculation is interesting, but company people STEEL talked with feel that's too much "togetherness" for them to accept at the present state of the bargaining art. They'd prefer to work under a contract extension, or without a contract as they did in '58.

• **Counterdemands**—Automakers have become increasingly astute about bringing their own proposals to the bargaining table instead of waiting for the union to make demands. They are expected to offer an extension of present contracts, although some authorities think they'll be willing to settle for the equivalent of a 3 per cent increase over the 1958 package.

Cost of living increases will be debated, although Mr. Reuther says he'll never surrender them. Questions will be raised about the validity of the consumer price index as a measuring stick. Some say it's too sensitive. The advisability of quarterly changes will be challenged. Automakers agree that some sort of adjustments are needed, but they aren't sure whether they should ditch this method of compensation. GM originated the system and may be reluctant to scrap it for that reason. Negotiators may prefer to extend the time between changes or the amount involved in each change.

• **Communications**—With a Democratic administration, Mr. Reuther may run to Washington for aid if talks bog down—and get publicity. This year, automakers are determined to give the public their side of the story.

Fringe benefits will be publicized. Automakers think workers and the public have become sophisticated about the relationship between direct wage hikes and inflation, but they feel that the average worker still doesn't understand how much fringe benefits really cost. "How we explain this will be more important than what we say or what media we use to get the message across," asserts one bargaining chief.

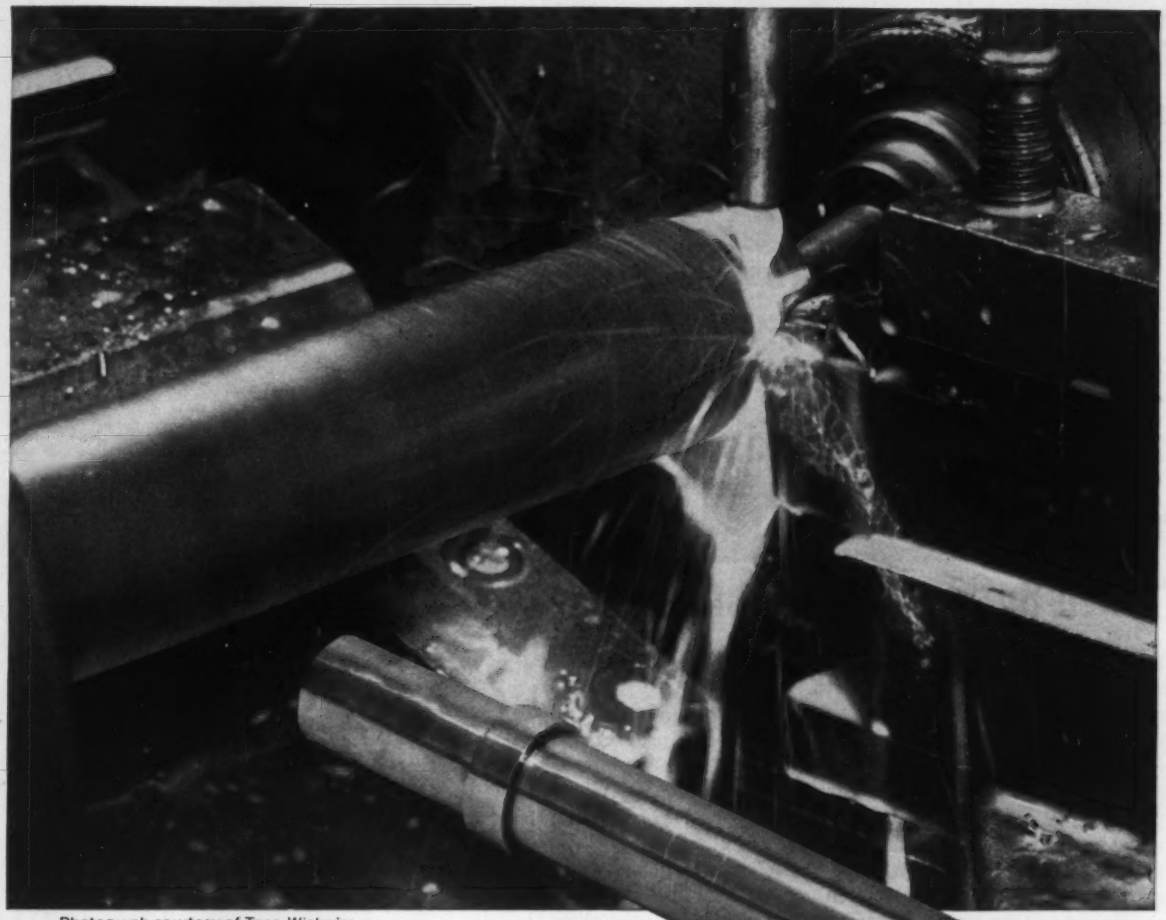
Productivity will be re-aired. The basic controversy will probably involve the "saucer shaped" productivity curve espoused by the UAW's Nat Wineberg and the straight line projection automakers believe is a more accurate, long range measurement.

Look for GM to again survey salaried line executives to get their impressions of changes that would be useful in day-to-day operations. Ford has been collecting cost data on foreign made parts which it may use for table talk (STEEL, Oct. 3, 1960, p. 55).

Is Reuther's Silence Golden?

Right now, autodom's biggest concern is the awesome quiet surrounding Solidarity House. Walter Reuther's silence is unnatural—and unnerving to industry bargainers. He may be resting (it's rumored that he's worn out physically); or he may be concerned about the impact of foreign competition and doesn't want to push too hard; or he may be consolidating postelection committees; or he may be laying low deliberately, waiting to launch a surprise attack. His comments at the December skilled trades conference in Chicago may be the signal that he's beginning his customary speaking again.

Talks will open officially in July. You can be sure that automakers will go all out to get a better return on their investment in people power.



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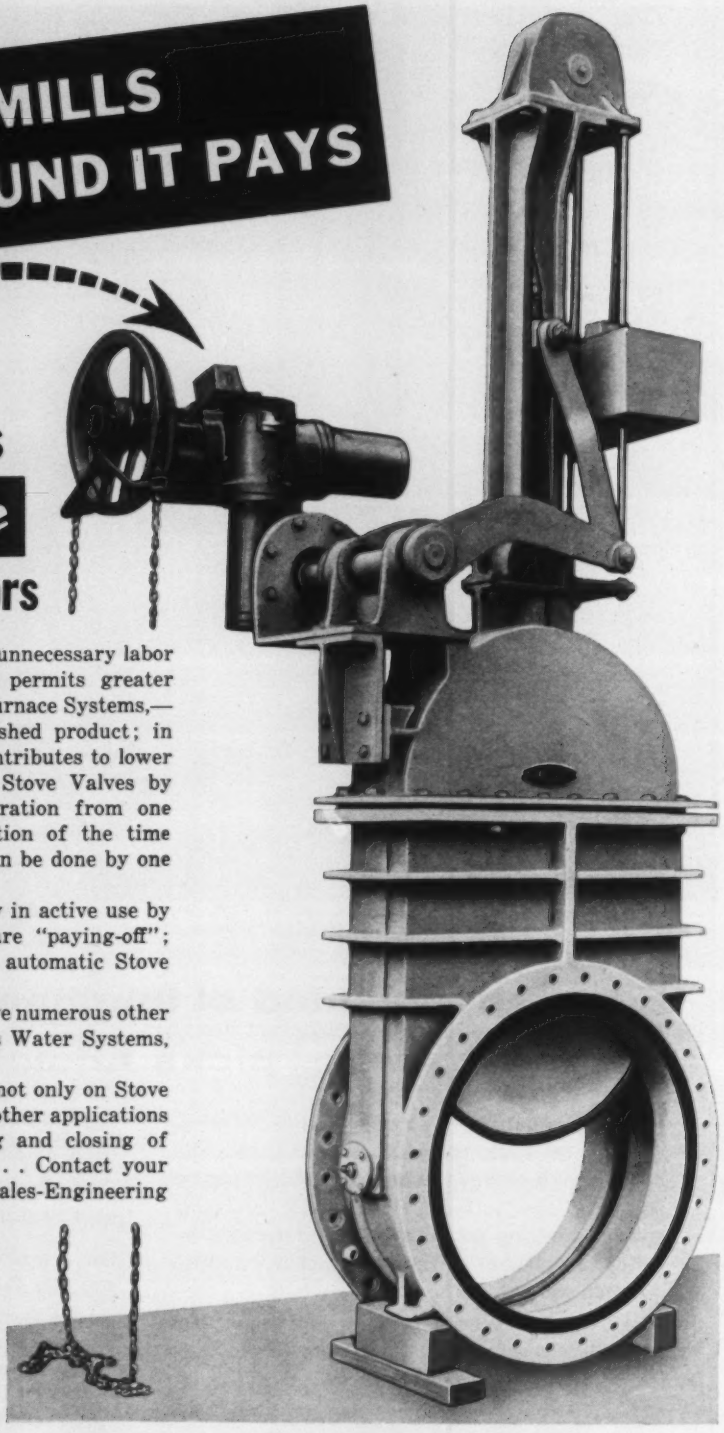

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1961 FORUM ON TECHNICAL PROGRESS

On the following pages, 244 metalworking experts give their predictions of this year's technological trends and developments. Included in their forecasts: Teflon dies for forming titanium, stainless steel (Page 216), 30 per cent stronger ceramic cutting tools (Page 210), a new steel combines workability, high strength (Page 173). Sections begin on these pages:

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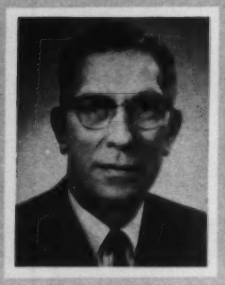
SERVICE AND MAINTENANCE 257

HARRY W. McQUAID
Consultant
Cleveland



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TECHNICAL PROGRESS

Steelmaking

More research, progress in steel technology should improve position of U.S. steelmakers in their contention for world markets

Steelmakers in U. S. Need Industry-Wide Research

Harry W. McQuaid—Technical progress in U. S. steelmaking can be spurred by an industry-wide research program and by the greatest possible effort on the melting of iron ore, the direct reduction of molten ore, and its continuous treatment to make fluid, semifinished steel.

Whatever progress we make in the elimination of high grade coke as the basis of hot metal economics will be of greatest commercial value to those nations that can get iron ore but not coking coal. What that will mean in the world steelmaking picture only the next ten years can tell. But we must face that fact—the future of our iron and steel industry will be affected.

Heat Treatable Steels Used In Cold Extrusion Processes

A. G. Forrest—The manufacture of steel products by cold extrusion, or by combinations of cold heading, extrusion, and forging, continues to increase rapidly. Many small automotive parts, several of them in complex shapes, are made by those methods.

Early developments involved low carbon, low manganese, low silicon, fine grained killed steels, such as C-1010 or C-1015, almost exclusively. That type steel is extremely adaptable to cold forming. But most of the parts required heat treatment, carburizing, or carbonitriding, with subsequent heat treatment to obtain functional hardness levels. For some time, that presented a difficult barrier for the steelmaker and for the application of the cold extrusion process, but now a wide range of heat treatable carbon and alloy steel compositions is being furnished.

Example: A rifle barrel that requires a high hardenability steel but also one that is readily machinable.

Steel, Chemical Industries Sharing New Technology

George E. Kopetz—Interchange of new technology continues to grow between the steel and chemical industries. It will undoubtedly accelerate the advancement of metalworking technology.

Joint development work by the metalworking and chemical industries has resulted in wider use of plastic, resinous, and metallic coatings on carbon steel piping, and equipment to replace more expensive alloy steels in certain mildly corrosive and low temperature services. Plastic coating has also increased the use of steel for structural and architectural purposes where strength, beauty, and permanence are prime considerations.

The metalworking industry has pushed the development of lighter gage sheet, plate, and piping materials. That has reduced over-all costs and increased the use of alloy metals in chemical and resin manufacturing plants.

Chemical engineers have contributed to the commercialization of new metal processing techniques, such as direct reduction of iron, improved sintering, chemical beneficiation of metallic ores, production of hydrogen for direct reduction, oxygen enrichment of blast furnace gas, and production of chemicals from coke oven gas.

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Industry in U. S. May Profit From Slumping Steel Sales

Leo F. Reinartz—In the steel industry, 1960 will be remembered as a year that started strong but finished weak. It was a year for economic belt tightening; marginal equipment and operations were eliminated. Plans were perfected for cost reduction and plant improvements. But the year may have been a blessing in disguise because it has put the industry in better condition to meet competition.

In ironmaking, plants that have beneficiated raw materials by ore bedding or other means, and by lime sintering the fines, are being rewarded. Blast furnace production has increased, and costs have come down. Uniformity and quality of iron have improved.

In the production of steel, it has long been the practice to use open hearth end burners to intensify flame temperatures. In the last two years, in an increasing number of plants, one or more lances have been installed in open hearth roofs to inject oxygen directly onto the bath, to speed melting and decarbonize the heat.

At least one producer has injected fuel and oxygen through roof lances to speed melting.

Open hearth end burners will continue in use for heat up, bottom making, and possibly during finishing. But the main work of the furnace in melting and refining will be carried on by oxy-fuel roof lances, and the open hearth will become a modified oxygen furnace.

Continued Effort Expected In Continuous Casting

Norman P. Goss—Development work will proceed on continuous casting. No major U. S. steel producer will install the process in the near future, but a few, small tonnage plants may do so.

In Europe, the process is undergoing steady refinement, which will be closely observed by U. S. industry. Most plants in successful operation cast small section bars. The practice is justified when plants produce a high cost product.

Success of continuous casting on a large scale depends on the choice of section. A slab of large section is easier to cast, more troublefree, and can be carried out at low cost. It is reported that in the near future a plant to cast a 6 by 60 in. slab will be operating in Germany.

Continuous casting plants built in the last ten years have been expensive, but a large part of their cost is reflected in experimental effort and development of knowhow.

Technological Progress in Steel Industry Continues

F. M. Rich—The trend in iron ore agglomeration predicted in 1959 became a reality in 1960. It will continue in 1961, with more attention being given to techniques that yield uniformly compact products better suited to shaft smelting operation than sinter. Such improved pellets were produced in large quantities last year. Blast furnace productivity, improved so much in recent years by improved technology, will reach new levels as large quantities of improved agglomerates become generally available.

The use of supplementary fuels such as oil, natural gas, coke oven gas, and powdered coal in the blast furnace is expected to increase.

Studies of several direct smelting schemes should progress to the point where their economic potential can be evaluated. The major contribution of those processes will probably be elimination of metallurgical coke as fuel.

Work is being done to restore the technical prominence of open hearth steelmaking. Much development work has been done toward the use of highly efficient, fuel-oxygen burners.

In basic oxygen steelmaking, the trend will be to larger furnaces. Several oxygen processes in use over the world will be evaluated in the coming year, and the conditions required for a given process will be better understood.

COKE & IRON

Changes Coming in Coke Ovens —Byproducts Less Important?

Philip S. Savage—The continuing decline in profits from byproduct coal chemicals will make it even more necessary to get maximum efficiency from present ovens and those being built. That puts more emphasis on the need for higher capacity ovens, automatic equipment, destruction of byproducts rather than their recovery, and even the consideration of nonrecovery ovens.

Delegations of coke oven operators and engineers from the U. S. visited European coke plants in 1960; they saw ovens larger than any on this continent. Some experts say that ovens higher than 16 ft, with a coal capacity of more than 20 tons, can be built, heated, and operated with European coal and labor. But the savings offered are so small that we probably shouldn't build ovens larger than the ones we have—with the coals that are available and with present labor conditions. Relatively small savings might soon be lost in shortened oven life, higher maintenance, added cost of coal preparation, and the probable premium cost of highly contracting coals.

New Practices Increasing Blast Furnace Productivity

T. F. Olt—Increased use of improved blast furnace techniques is expected to bring still greater iron production from

Steelmaking

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Gas Products Dept.
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Union Carbide Corp.
New York

present facilities at decreased coke rates.

Progress in improving blast furnace technology was probably more rapid in 1960 than in any period since the hot blast was introduced. More agglomerates are being produced from beneficiated ores with a high iron-silicon ratio. The agglomerates are predominantly fluxed sinters and pellets. Fines from direct shipping ores are also being sintered in rapidly increasing tonnages.

Coke used in smelting is also better because of extensive installation of facilities for coal washing, improved blending, and pulverizing.

Productivity has been increased on blast furnaces receiving such raw materials, so that charge materials are no longer the bottleneck that limits production increases. And coke consumption has been decreased materially.

Oxygen enrichment, through humidification and oxygen addition to the blast, has also contributed to increased productivity. Such procedures are especially useful when blowers are operated to capacity.

Progress has been made in the injection of mobile fuels to the blast furnace hearth for greater coke economy. The practice, employing coke oven or natural gas, has been tried on several furnaces with highly encouraging results. Further trials, employing fuel oil and pulverized coal, are underway. Fuel injection into the hearth requires either increased hot blast temperatures or oxygen enrichment to realize the desired coke savings. That has focused attention on improvement of stove performance and on the reduction of oxygen production costs.

Low Grade Ores and Coals Will Yield Low Cost Iron

P. W. Bakarian—Use of higher iron content ores in the blast furnace gained momentum in 1960. The practice will probably become an economic necessity in the early sixties. Expected results: Price premiums on high iron, uncontaminated ores, and further discount on the price of ores containing less than 50 to 55 per cent iron. Ores contaminated with sulfur, phosphorus, titanium, and chromium are already heavily discounted or unusable in the blast furnace.

That situation should be exploited commercially by the rotary kiln, direct reduction process in the next three years. Negotiations are underway to install such reduction plants in Europe and the U. S. for converting low cost ores to pure iron by submelting point processing.

The status and expectations of the kiln type direct reduction process can be summarized this way:

1. Commercialization of the rotary kiln iron process was delayed in 1960 by the downward trend in steel demand, by the drastic drop in scrap prices, and by the 10 to 25 per cent lowering of operating costs on blast furnaces using beneficiated feeds and taking advantage of the latest operating practices.

2. Kiln direct reduction has revealed a lowering in briquet iron costs. That competitive position of the rotary kiln vs. the blast furnace has been made possible by ore and coal price situations that cannot be exploited in blast furnace ironmaking.

3. Large scale, feasibility tests on widely available iron ore reserves have proved the method and detail economics of the kiln reduction technique. Those same ores aren't usable in conventional blast furnaces. That is significant to the expanding world steel demand and permits realistic evaluation of the U. S. and foreign iron ore reserves.

4. The economic usability of low cost, widely available bituminous coals is being demonstrated on a commercial scale and will permit bypassing of expensive coke ovens and byproduct recovery plants. It will also spread the raw fuel base, so important to the economics of iron production.

5. Progress is being made on direct-reduced-iron utilization economics. Commercial scale tests in the last year have highlighted the steel ingot quality advantages to be gained from using high purity, briquet iron, free of metals such as copper, lead, and tin. And combination of the kiln reduction step with conventional steelmaking processes for ingot production (electric furnace, open hearth, hot blast cupola, and oxygen converters) is opening new areas for lowering the basic cost of steel.

STEEL MELTING

Oxygen Steelmaking Methods To Continue Growth in 1961

John K. Stewart—Oxygen consumption per ton of steel produced will continue to rise in 1961. Our company is constructing ten, on-site oxygen plants to supply major steel complexes—five in the U. S. and five for foreign operations. Combined production of the five domestic plants will be more than 2100 tons a day.

Oxygen consumption in open hearths is increasing rapidly. An oxygen-fuel gas lance introduced in the last year consumes oxygen at 1500 (or more) cu ft per ton of steel but speeds up refining by more than 200 per cent. Application of the lance to oxygen vessels to increase scrap melting capacity is in the development stage.

Further developments and an increasing awareness of the economies of oxygen steelmaking will continue to raise the oxygen consumption per ton of steel for the next several years. On completion of a new oxygen plant in the near future, one U. S. steelmaker will use 2800 cu ft of oxygen per ton of steel. Forthcoming technological developments should put other major steel producers closer to that rate.

Much of the growth of oxygen production will come from increased acceptance of oxygen enrichment for blast furnaces as a way to increase iron production with little or no capital investment by

the steel company. Such an increase is over and above improvements gained by other means.

Many Oxygen Applications Save Money for Steelmakers

J. A. Hudson—Most steel mills are reducing production costs with oxygen from on-site production facilities. Our customers are using an average of 565 cu ft per ingot ton of steel; that figure will be close to 750 cu ft by the end of 1961.

Open hearths using hot metal can save $1 to $3 per ingot ton in fuel, flux, and labor costs through the use of oxygen. And the greater production from fewer furnaces eases material handling problems. Cold metal shops also need oxygen for faster melting. Auxiliary, oxy-fuel burners are being used more widely. Low scrap prices indicate a need for flexibility in hot-cold charge adjustment.

Addition of natural gas to the blast furnace is beyond the testing stage. Oxygen with natural gas becomes economically desirable as stove capacity is reached. Such oxygen use will be tested in several furnaces in 1961. Areas where gas costs are low and coke costs are high will be the first to adopt it.

Electric furnaces are using oxygen for decarbonization. Wall burners are also being used to save electrodes and time in the electrics. Oxy-natural gas flames can be varied from oxidizing to carbonizing. Some control of smoke is possible through proper flame adjustment.

Work is underway on a checkerless, open hearth that uses oxy-fuel burners for scrap and pig melting. Close control and low capital cost should appeal to smaller steel producers.

Vacuum Casting Techniques Promise Better Properties

M. W. Lightner—Vacuum casting techniques are certain to be used more extensively to produce low hydrogen, alloy steels less susceptible to internal defects and with improved tensile ductility. They will also be used to produce carbon-deoxidized steels for many applications. Research on methods for reducing surface defects, so conditioning costs can be lowered, will lead to novel casting techniques.

Continued improvement in roof design and the quality of basic refractories permit operation of basic open hearth furnaces at higher firing rates and with increased oxygen lancing. Shorter heat times and higher bath temperatures point up the need to develop sturdy devices for continuous bath temperature measurement to prevent damage to furnace bottoms and other refractories.

Decreases in open hearth heat times will put more attention on materials logistics—the movement and charging of hot metal, scrap, limestone, and ore, and the handling of steel and slag from the furnace. Such time savings will also stimulate research on the development of sensing devices and instrumentation so the open hearth operation can be programed and put under automatic control.

Oxygen, Vacuum, Inclusions Hold Spotlight in Melting

Walter M. Patterson—A glance at the subjects prominent in discussions at technical meetings provides a comprehensive look at the latest developments in steel melting.

In the last 15 years, oxygen has been called one of the most effective tools to aid steel melting. Its applications seem unlimited. Its use is usually controlled by availability and cost (which are functions of plant size).

Residuals are still a problem in high alloy steels. They are usually introduced in melting, through the use of unknown scrap, but many of us are asking ferroalloy producers to become more aware of trace elements in their products. In the past, they may not have been considered important enough for analysis.

Inclusions and their sources is another vital area. Ideas and methods for their detection, control, or elimination are always interesting.

Yields, from ingot to semifinished or final product, take on a new look as exothermic, insulating boards in conventional, big-end-down molds gain popularity.

Vacuum melting, degassing, and pouring procedures are advancing rapidly; in a few years, they will certainly have grown to stature similar to that of oxygen use.

Final products are improving greatly in quality and finish—our company recently announced a brighter finish on stainless products.

Electric Furnaces Gaining In Unsteady Steel Market

James King Jr.—Melting rates of 30 to 50 tons per hour and electric furnaces in capacities of less than a ton or more than 200 tons will fit into the plans of almost any steel producer. Many new electrics are being installed—at low capital investment—near their ultimate metal market.

Easy startup and shutdown, key features of electric furnace operation, assume even greater importance in periods of low and varying metal demands. With customers carrying smaller inventories, steel producers are receiving small and frequent orders. Those with versatile, electric furnace facilities are meeting sporadic demands easily and economically.

Stainless, carbon, alloy, and tool steels (also Ductile Iron) can be produced in the electric furnace. Low cost scrap, hot metal charging, oxy-gas burners, and uniform power costs combine to make

Steelmaking

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Electric Melting Consultant
Allegheny Ludlum Steel Corp.
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Steelmaking

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R. P. HEUER
Vice President
General Refractories Co.
Philadelphia

the electric furnace a must in any melting plant.

REFRACTORIES

Refractories Keep Abreast Of Steelmaking Technology

Raymond E. Birch—A third of all open hearths now have basic roofs; in this period of reduced operations, it is likely that those furnaces are accounting for over two-thirds of today's steel production. And they are the hard driven furnaces, where production rates and the use of oxygen are at the maximum.

In the future, much is expected of new grades of refractory magnesia up to 98 per cent pure. They are coming into production for spall resistant products.

Teachings of the open hearth roof are being extended to other parts of the furnace and to the roofs of large electric furnaces. Application of metal cased, basic brick in such areas has been impeded because of the tendency of electric current to flow through the refractories in the center sections. But those problems have been solved.

A new process that gives extra density to high alumina refractories has made available a 90 per cent alumina brick for services that have historically been hard to handle. Its structural stability extends several hundred degrees above some of the earlier alumina refractories. Evaluation under load of 25 psi must be done at 3200° F to obtain any measurable yield. The product is of interest to designers of superstoves now under consideration for the blast furnace, and for the furnace proper, in the bosh, lower inwall, and top wearing sections.

Silica refractories, which have been replaced in some areas, are more firmly entrenched in other steel plant applications. Their unique properties insure continued use in byproduct coke ovens. They remain a major open hearth refractory and are most economical for the roofs of medium sized or intermittently operated furnaces.

Improvements in Refractories Pacing Steel Technology

James P. Raugh—New types of refractories will be supplied in 1961 to accommodate the higher temperature operations that typify advances in iron and steel production. Increased use of better basic refractories in open hearths, electric furnaces, and oxygen converters is expected.

High purity periclase is used in all types of basic brick and specialty mixes; previously, it was used only in premium products.

New and improved open hearth roof designs, suspensions, roof cleaning, and built-in features (such as integral expansion relief in metal clad brick) will receive additional attention from brick users and producers in an attempt to reduce installation and operating costs.

Blast furnace production rates are being increased by several means. That puts more severe service demands on refractories. Improved, semisilica brick are being used for domes and upper sidewalls of stoves. Several installations of mullite brick have been made in the upper checkers and combustion walls. In the blast furnace proper, increasing consideration is being given to the use of mullite and high alumina brick. To supply that need, attention is being focused on synthetic mullite.

High Process Temperatures Demand Better Refractories

R. P. Heuer—The all basic open hearth continues to gain popularity. Most of the open hearth steel being made in the U. S. is produced in furnaces with basic ends and roofs.

Addition of roof oxygen lances to open hearth furnaces has increased the annual production capacity of U. S. open hearths. But it has also made basic roof refractories a requisite for reasonable furnace availability. With basic roofs and oxygen furnace production, rates of 60 to 80 tons an hour aren't uncommon for extended periods; rates of more than 150 tons an hour have been reached on experimental heats. (Five years ago, 25 tons an hour was considered an extremely good rate.)

The question as to whether chrome-magnesite or magnesite-chrome roof refractories offer better service is still unanswered. But properly compounded, chemically bonded bricks seem to outperform burned refractories.

Generally, in the large, high production, open hearths, using high fuel and oxygen output, the higher magnesia refractories offer greater resistance to wear from the reducing atmosphere in the furnace. But if rapid temperature fluctuations occur, the greater spalling resistance of the chrome-magnesite refractories can make them more desirable than the magnesite-chrome materials.

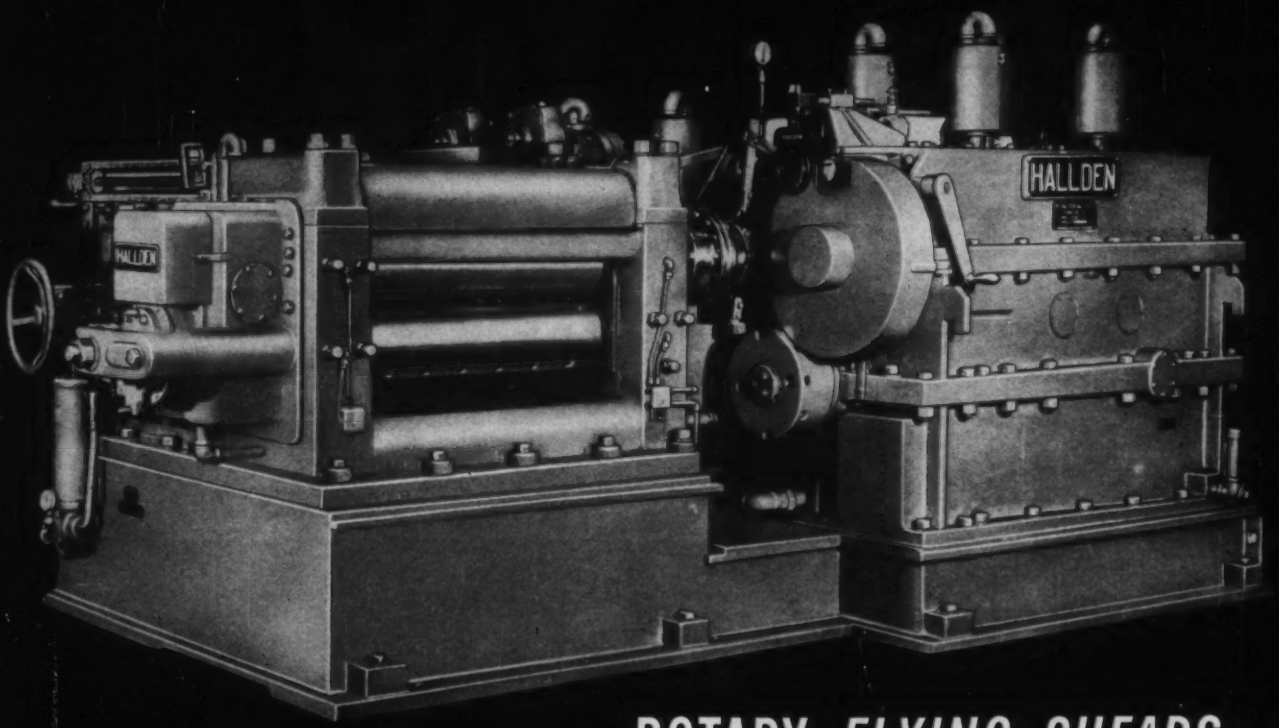
Wide variations of service results have been obtained with both types. Roofs of both materials have been completely consumed in less than 100 heats, or have lasted for over 750 heats, in different furnaces. The variations can be caused only by differences in operating conditions.

Further improvement of bottom materials for open hearths with higher magnesia content and lower impurities (particularly silica and alumina) seem to be needed.

Increased use of pneumatic spray equipment for preventive maintenance of front and back walls has gained wide acceptance.

Experiments are continuing on refractories for basic oxygen furnaces; no definite trend has been established, but the

(*Please turn to Page* 150)



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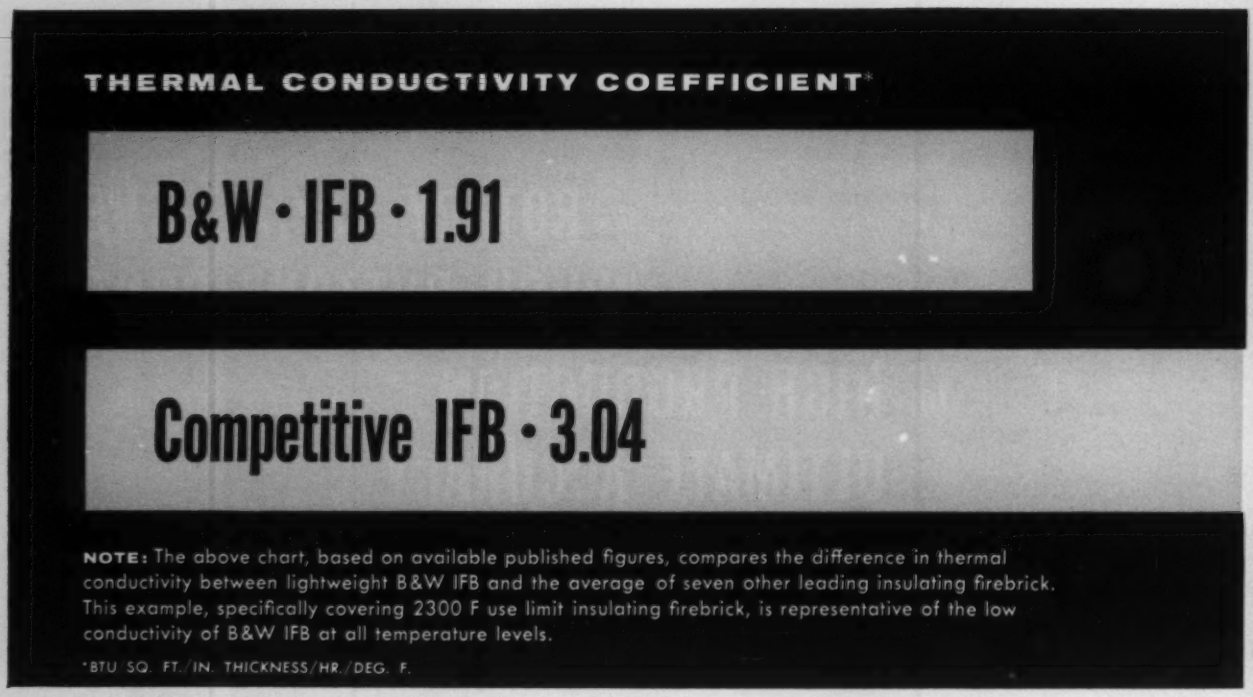
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*BTU SQ. FT./IN. THICKNESS/HR./DEG. F.

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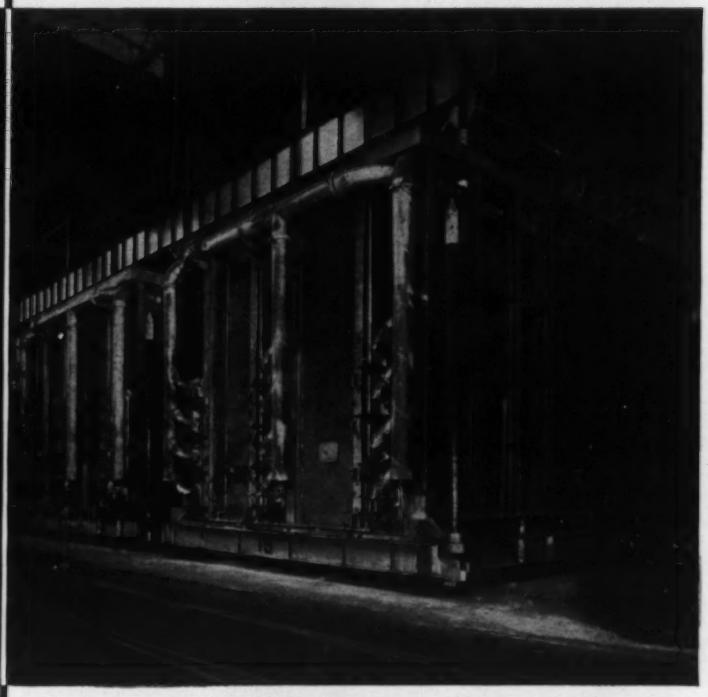

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Vice President
Refractories & Chemicals Div.
Kaiser Aluminum & Chemical Corp.
Oakland, Calif.

(*Continued from Page 146*)

use of higher magnesia content and higher quality magnesites in such refractories is increasing.

In blast furnace refractories, the most promising development is the use of hydraulic setting fireclay, and high alumina castables for lining repairs. Such repairs are usually made with pneumatic guns over the eroded areas.

Refractory Improvements Promised by Producers

Charles A. Smith—Emphasis on the development of higher performance refractories for the steel industry will continue in 1961.

Use of basic refractories with high magnesia content is still increasing. The refractories industry has improved the performance of bricks in open hearth roofs in the last year, but when more is known about the physical requirements of those refractories, better bricks will be developed and longer furnace life will be possible.

Emphasis on the use of castables and ramming mixes, including materials designed for pneumatic gunning, will continue as part of the drive for better performance. Gunning isn't new, but its benefits are becoming more widely recognized in the steel industry. Gunning of specialized castables for extensive repairs to blast furnace lining is getting considerable attention.

In addition to its use for repair and maintenance, the gunning technique is being used to form monolithic refractory structures in a wide variety of furnaces. That could lead to completely new concepts and cost savings in the

Photo courtesy of Jones & Laughlin Steel Corporation

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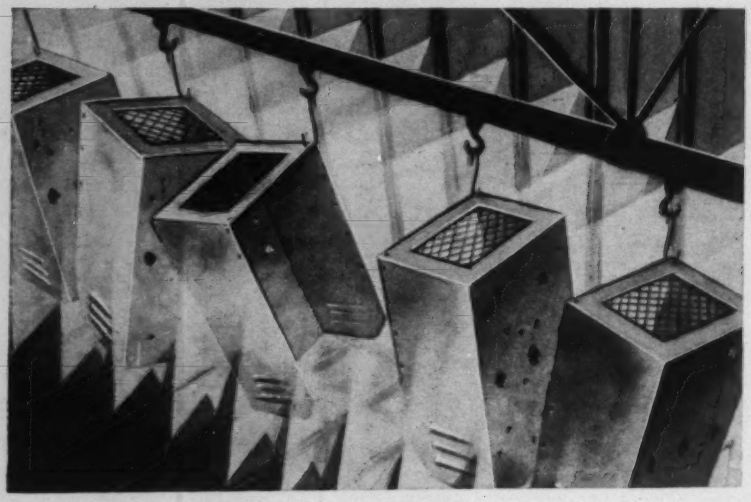

New acid cleaner Oakite 86 gives fast smut removal... good paint grip

Shop smuts on steel parts disappear fast with Oakite 86 in the washing machine. A superior acid detergent, it removes all kinds of soils efficiently—really goes to work on heavily smutted steel. In addition, it forms a conversion coating on steel surfaces to give a good grip on subsequent paint coats ... helps inhibit corrosion.

Oakite 86 also works well when aluminum, zinc, brass and terneplate pass through the washer.

And it is just the latest in a complete line of Oakite materials for spray washing machines. Others include products for high-pressure spraying, for rapid cleaning, for heavy-duty cleaning, for low-heat cleaning, for conversion coatings. Ask the Oakite man which one will work best with your machines, your metals, your specific jobs. Or, write for FREE bulletin. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

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SCIENCE

over 50 Est. 1909 *years' leadership in industrial cleaning*

Steelmaking

STANLEY E. JACKE
President
Ultrasonic Manufacturers Association
Branson Ultrasonic Corp.
Stamford, Conn.

design of refractory structures.

Dolomitic refractories for basic oxygen furnaces have shown considerable improvement in the last few years. Performance of those refractories in the vessels continues to improve. Problems connected with the hygroscopic tendencies of the bricks have largely been solved, and hydration resistant bricks that can be stored for long periods will soon become more generally available.

CLEANING & DESCALING

Ultrasonics to Offer Steel Cleaning Savings This Year

Stanley E. Jacke—Advances of the last two years indicate that the principles of ultrasonic cleaning can be applied to many finishing processes for steel strip and sheets. Advanced designs have reduced initial and operating costs to a point where ultrasound can compete with present methods.

Three major areas of application being considered by steel people: Removal of shotblast residue, elimination of pickling smut, and cleaning of cold reduced stainless and low carbon strip.

Extensive trials indicate that ultrasonic cleaning in an alkaline or detergent solution will effectively remove the residue of shotblast descaling of hot rolled strip. Commercial quality, low carbon, cold rolled strip can be produced that way.

Relatively low cost installations at the entry or delivery end (or both ends) of standard strip picklers are justifiable. Cleaning following scale breaking would remove loose scale, reducing the rate of

Steelmaking

R. M. TRENT
President
Pangborn Corp.
Hagerstown, Md.

acid depletion in the entry pickle tank; smut removal following pickling would insure high quality, cold mill feed material.

The replacement of rotary scrubbers with ultrasonics in conventional alkaline or electrolytic strip cleaning has the advantage of increased exposure to scrubbing action without physical contact. We expect such an installation will be operating early in 1961 on 36 in. strip.

Shotblasting to Make Gains In Descaling Applications

R. M. Trent—Real progress is expected in abrasive descaling for all types of rolled and drawn steel products in 1961. With the federal government edging into stream pollution control, steel producers realize that a permanent solution must be found before long. Fortunately, blast descaling offers important operating economies beyond the reduction or elimination of stream pollution.

A new, hot rolled, carbon steel descaling line, started in 1960, handles coils up to 32 in. wide at 300 linear feet a minute. Scale is removed by a dependable, high performance, shotblasting cabinet. A flash pickle removes residual dust. Many new features are incorporated in the unit to eliminate mechanical interruptions.

Ultrasonics has been teamed successfully with shotblasting to eliminate even the flash pickling requirement. An experimental ultrasonic unit has been installed and used successfully to prepare low and high carbon steel coils for cold rolling. The product was equal to steel rolled from hot bands that were descaled by acid immersion.

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General Sales Manager
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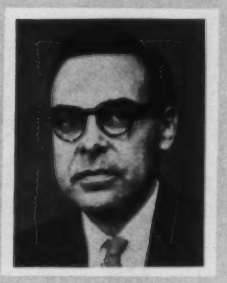


D. W. MITCHELL
Director
Research & Development
Foote Mineral Co.
Philadelphia

DAVID SWAN
Vice President, Technology
Union Carbide Metals Co.
Division of Union Carbide Corp.
New York

TECHNICAL PROGRESS

Nonferrous Metal Production

The industry will build on aluminum's success with the automobile engine. Copper and brass mills cite economic, competitive problems

Rare Earths, Columbium Find Expanded Steelmaking Uses

Norman F. Tisdale—The rare earths and columbium are receiving widespread attention from the iron and steel industry.

The use of rare earth flux to produce rimming steels has been widely tested. Advantages include fewer surface defects, lower sulfur throughout the ingot, and a much more uniform chemical analysis.

Two new applications for columbium have been found in steelmaking: 1. As an addition (usually 0.20 to 0.40 per cent) to Type 435 stainless to prevent roping. 2. In flat rolled products, the addition of 0.01 to 0.03 per cent columbium has produced a steel with higher yield strength while maintaining excellent weldability and formability for many parts.

Precious Metals Being Tapped To Solve Space Age Problems

Paul G. Feld—More and more applications of gold and silver alloys will find their origin in problems, such as the subminiaturization needs of the electronic and electrical industries and the temperature barriers encountered in the missile industry.

Precious metals, especially silver and gold and their alloys, will continue to show increased usage in all branches of industry. Conventional applications for silver brazing alloys and the use of silver alloys for electrical devices will grow with increases in consumer durables.

Technological advances in the electrical and electronic industries are creating unusual raw material requirements. Gold and silver alloys are being used to solve current density, subminiaturization, thermal and electrical conductivity, resistivity, and semiconductor problems—to mention but a few—at ever increasing rates.

Cites Potential for Lithium In Metallurgical Uses

D. W. Mitchell—Developments in both ferrous and nonferrous metallurgy indicate an increasing use of lithium metal. (Principal applications now involve lithium as an alloying element or as an additive in the manufacture of steel and nonferrous metals.)

One major aluminum company has incorporated lithium in an aircraft alloy that is lighter than conventional types and will withstand temperatures up to 454° F. Designated X2020, the alloy has been tested under severe service conditions—it forms the skin of the Navy's A3J Vigilante.

Experimental work in the lead-lithium system has revealed some interesting properties: Increased hardness and tensile strength and a shielding effect against nuclear radiation.

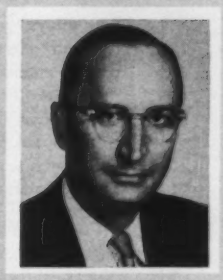
Other light metal alloys with lithium as a component are being investigated, with emphasis on unique and desirable properties for industrial applications. In the military field, an alloy of magnesium and lithium has been studied as a possible lightweight armor plate metal.

Metallic lithium has shown promise as a degassing agent for steel and nonferrous metals.

In steel, special capsules make it pos-

HEINZ V. MENKING
General Director, Product Development
Reynolds Metals Co.
Richmond, Va.

DAVID LAINE
Secretary
American Die Casting Institute Inc.
New York



J. H. LINDEMUTH JR.
General Manager, Metals Div.
Kaiser Aluminum & Chemical Corp.
Oakland, Calif.

PIERCE M. WELPTON
President
Bridgeport Rolling Mills Co.
Stratford, Conn.

sible for the lithium (its melting point is 367° F) to be kept in the melt long enough to produce the desired effects. Result: Reduced gas content, less embrittlement and inclusions, and in general, improved grain refinement.

No. 1 Target: Better Ways To Form Refractory Metals

David Swan—The main, short range problem in refractory metals is to establish fabrication technology for processing ingots into sheets and other mill product forms. A second problem is the protection of these metals in applications involving lengthy exposure to high temperatures. Coating materials under study include Nichrome alloy, stainless steel, chromium, and modified molybdenum disilicide. A third problem is the accumulation of high temperature engineering data.

Work will continue in 1961, as during the past five years, on perfecting technology for extracting refractory metals from their ores to give good quality primary metals. Such processes and improved techniques of arc melting and electron beam refining can be expected to yield higher purity columbium and tantalum and to give the metals better workability and high temperature characteristics.

Continuing strides will be made in alloy technology. Now possible: Alloys of columbium with tungsten, titanium, aluminum, and vanadium which have four times the strength and 50 to 100 times the oxidation resistance at 2000° F of the metal itself. Fabrication properties are not adversely affected. Dispersion hardening and solid solution strengthening techniques also show promise.

Advances must be made in processing tungsten for high temperature alloy use. There is a particular need for suitable techniques for producing this metal in mill product forms.

ALUMINUM

'60 Developments to Help Extend Aluminum's Role

Heinz V. Menking—The quest for new, major aluminum markets will be aided during 1961 by last year's product engineering and development. Development programs will continue at a high level with the goal of expanding markets by solving fabrication problems, improving competitive position, and finding new and better ways of designing, forming, joining, and finishing aluminum products.

Emphasis will be placed on architectural and construction materials. Although an all-aluminum house is technically feasible today, the goal of architectural development is for maximum utilization of aluminum in combination with conventional materials to provide home buyers the greatest amount of livability per dollar of cost.

The transportation industry has never been more conscious of the inefficiency of excess weight in boats, automobiles, trucks, trailers, containers, and railroad rolling stock.

Diecasting Uses Spurred By Aluminum Engine Block

David Laine—In 1961, diecastings will gain a new and increasingly important place in metalworking. Production acceptance of diecast aluminum engine blocks for current model automobiles dramatically presages wider fields of application in which over-all economies of diecast components will be recognized.

The need for re-evaluation of the methods by which metal fabrications are produced is clearly indicated. A growing trend to improve product performance through redesigning to diecasting is already underway.

New production techniques resulting in higher quality levels were perfected and adopted by diecasters in 1960 after exhaustive testing by the Die Casting Research Foundation of the American Die Casting Institute.

Aluminum Industry Boosting Quality of Ingots, Billets

J. H. Lindemuth Jr.—The primary metal now available to aluminum users is of better quality and better adapted to production requirements than ever before. Further advances are being steadily made.

The fact that aluminum ingots and billets today are quite different products from just a few years ago tends to be overshadowed by the attention given to expansion of applications such as the adoption of aluminum engines in the automobile industry and development of improved fabricating and finishing techniques.

One of the most significant steps forward during the last year was the introduction of new types of extrusion billets in 6063 alloy. Extruders have been enabled to achieve higher production rates, better finish, and improved properties.

Those beneficial results stem from closer attention to tailoring products to users' requirements as well as to the development of improved fluxing practices and methods of casting and pouring, and closer controls on minor impurities.

COPPER AND BRASS

Route Signs Posted for Brass Mill Technologists

Pierce M. Welpton—Technological development in the brass mill industry will

Nonferrous Metal Production

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Technical Director
Copper Products Development Assn.
New York

T. E. VELTFORT
Managing Director
Copper & Brass Research Assn.
New York

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Vice President
Revere Copper & Brass Inc.
New York

be markedly influenced by three factors currently of predominant concern: Intense foreign competition, high domestic labor costs, and materials substitution. In an effort to meet the challenge of all three, more highly automated production and material handling equipment must be developed covering all segments of manufacturing, resulting not only in lower labor costs but also improved products.

In seeking to hold existing markets and at the same time to expand sales aggressively into new fields, the brass industry must place increased emphasis on new alloys, greater uniformity in chemical and physical properties, and more precise establishment of specifications to meet the increasingly exacting requirements of highly specialized applications in the Space Age.

Research and development will play a major role in accomplishing these objectives.

Expanded Copper Research To Spark Radical New Uses

Charles H. Moore—Possibly the most significant development in copper technology in 1960 was the inauguration of a producer-sponsored international program of research to find new and improved uses for the metal. This "declaration of intent" by the world-wide copper producing industry to exploit the technological potentials of the world's oldest metal holds promise of radical innovations and solutions to industry-wide problems.

The research program of the Copper Products Development Association may result this year in as many as 20 to 25 separate studies sponsored at research institutes, industrial laboratories, universities, and other organizations that conduct contract research. No limit has been set on the scope of the program.

Our philosophy is to emphasize development of products that fit market needs, irrespective of price, competition, or traditional patterns. That may involve joint applications with other materials or the introduction of copper materials in radically new forms and concepts.

Paramount attention will be given to correcting or subduing technical deficiencies in copper (such as the tarnishing problem) so that the inherent values in the physical properties of the metal may be more fully realized.

Even though most of the research will be oriented toward products having immediate market potentials, a basic approach—going deep into theoretical considerations of solid state physics, physical chemistry, and atomic structure—will govern. A significant portion of the program will deal with fundamental studies having long range implications for products of 10 to 15 years from now.

New Alloys to Help '61 Brass Mill Prospects

T. E. Veltfort—New alloys, improved performance of existing ones, and expanded research and production facilities will enhance the technological picture for brass mill products in 1961.

Outstanding among new alloys is the rod introduced by a major brass mill that combines copper, lead, nickel, and phosphorus. Besides its free machining properties, it possesses high corrosion resistance and electrical conductivity. Timely, too, is the new condenser and heat exchanger tube alloy of another brass mill. It is the first commercial copper-base alloy to incorporate mercury. Still another company has announced a new high conductivity copper which is deoxidized by closely controlled additions of lithium. Because of its inherently contained silver, this copper is said to have above average strength and yield properties.

In the area of performance, we find a copper-nickel-silicon alloy replacing stainless steel in a faucet handle. Reason: Lower production costs. A tubed copper strip heat reclaimer saved a laundry more than $1400 in four months. Noteworthy, too, are the "pancake" type reels supplied by a copper tubemaker which allow a customer to use a new soldering technique to speed production of the copper coils for his water coolers. The reels feed the tube to the solderer at a constant angle and height. Without that constancy, the soldering operation would not be feasible.

Brass mill modernization and expansion continue apace. A Michigan brass firm is enlarging its heat transfer equipment facility at Danville, Ill.; a Connecticut mill has completed a 14,000 sq ft addition which houses finishing facilities, along with a newly equipped metallurgical laboratory; a New Jersey mill has extensively modernized its wiremaking operations. In Waterbury, Conn., a $1.5 million research center is rising; it will be devoted primarily to copper and its alloys. Another Connecticut brass company has installed equipment which enables it to increase the diameter of its clad tube sheets from 26 to 42 in.

Brass Mills Moving into New Metals and Processes

R. A. Wilkins—Recent trends in the field of aluminum and brass mill products are in large measure a reflection of demands created by: 1. Rapid advances in development of nuclear energy for military and commercial purposes. 2. Specialized requirements created by our missiles programs. 3. Many new and varied electronic developments.

As a reflection of those demands, we find the technical and production staffs of the various companies in the metals fields concerned with specialized alloys and other modifications of standard materials.

The development of a product such as tube-in-strip, for example, is a response to the demand for better heat transfer materials. It's being used more and more

in the cooling of high energy electronic devices.

We find also an increasing interest in the fabrication of the less common metals (zirconium, beryllium, columbium, titanium, and others) as well as in the fabrication of metal and ceramic combinations.

We are engaged in expanding our research and development staff and our facilities. Objective: To be prepared to process any of the less common metals on a pilot plant scale, or to explore any of the newer processing methods, as the occasion may arise.

Techniques learned by necessity in the handling of the less common materials are beginning to show up in the processing of the more common commercial metals. We see an increasing interest in such things as vacuum casting, controlled atmosphere casting and fabrication, and similar techniques.

MARKETS

Tungsten Consumption Up; Should Go Higher in '61

F. A. McGonigle—During 1960, two of the largest domestic tungsten producers resumed production after being closed down for about two years. The action was due to a firming of prices in the early part of the year and in anticipation of a firm and steady market in 1961.

Final figures for 1960 imports for consumption will probably show a reduction of 75 per cent from 1959's. The decline could easily continue into 1961, although at a lower rate.

Last year's consumption of concentrates will probably exceed 10 million lb compared with 9,835,000 lb in 1959. The increase should continue in 1961 because of renewed interest in defense spending.

A new, high temperature, tungsten-molybdenum alloy announced during 1960 looks promising; however, the impact of this development on consumption is not clear. It may replace some alloys now in use, rather than create a new use for tungsten.

Unless unforeseen world events upset the supply-demand balance, prices should continue stable at a somewhat higher level than at the end of 1960.

1961 Tin Consumption Could Hit 55,000 Tons

R. D. Coursen—It is expected that the steel industry in 1961 will consume at least 33,000 long tons of tin, while total consumption should reach at least 55,000 long tons.

Reasons for the expected increase: Consumption of soft drinks in cans is expected to reach 1.2 billion units; beer in cans is expected to show an increase to 9.9 billion units; the fruit and vegetable crop of 1961 is estimated to be greater than 1960's.

The introduction of new, thinner, stronger, lighter tin plate by most major steel companies in 1960 should also stem the advance of aluminum in the rigid container field and at the same time extend the market for tin plate into new fields.

It is reasonable to expect the second largest consumer of tin, solder, will participate in the projected increase in defense activities in 1961. That is particularly true because of the important place held by solder for joining purposes in the electronics field.

Fortunately for U. S. industrial users, tin production prognostications for 1961 are extremely favorable in Malaya, producer of more than one-third of the world's tin, and traditional supplier of well over half that used by U. S. industry. Known and calculated reserves of ore in Malaya are more than sufficient for the requirements of U. S. industry in the foreseeable future.

Marked advances are being announced by the Tin Research Institute in the use of tin chemicals. This year should see further uses of tin chemicals as biocidals, opacifiers, and stabilizers. Pharmaceutical technology indicates that 1961 will also show a marked increase in the use of pure tin tubes for the packaging of sensitive drug products.

New Emphasis in Titanium: Upgrade Alloys, Products

T. W. Lippert—Titanium metal shipments in 1960 appear to have increased at least 25 per cent over those in 1959. That improvement, largely unanticipated by the industry, demonstrates basically the effectiveness of the swing from new alloy introduction to a program having a broader base—that of improving properties and products in established alloys.

Increasing size ranges and developing higher mechanical properties through forging and heat treat techniques are permanent goals for the industry. Demonstrating progress: The beta alloy can now be produced in strip widths in gages down to 0.012 in., and yield strengths of 160,000 psi are being obtained in forged sections over 3 in. thick. Considerable effort will probably be made to develop strip rolling methods for production of the Ti-5Al-2.5Sn alloy which seems to be titanium's leading contender for cryogenic tankage at liquid hydrogen temperatures (minus 423° F).

The industry will stress the feasibility of the welded type product to build the tubing market. Thin wall, as-welded tubing, or welded and redrawn tubing, can be specified for a variety of applications once reserved for the more expensive seamless tubing product.

Two new alloys demonstrated a staying power in 1960. One, titanium alloyed with 0.15 per cent palladium, has the potential of becoming the basic titanium grade used by the chemical process industry because of its corrosion resistance in environments that fluctuate from oxidizing to reducing. A new aircraft alloy, Ti8Al-1Mo-1V, shows marked improve-

Nonferrous Metal Production

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Nonferrous Metal Production

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Executive Vice President
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New York

ments in creep properties over currently employed alloys, indicating that titanium will be used at much higher temperatures in the coming generation of aircraft jet engines.

The industry can expect a continued increasing demand from the chemical industry, with an outside chance that 200,000 lb of metal will go to that market in 1961. Manned aircraft will continue to account for the bulk of titanium purchased, with the missile market perhaps rising to about 20 per cent of total titanium sales this year.

Market for Molybdenum In Steelmaking Expanding

J. Z. Briggs—Industry is paying increased attention to the economics of wear, particularly in the mining and earth moving fields. Profitable recovery of low grade ores has been made possible not only by improved technology but also by low unit costs in mining and milling operations. Consequently, there has been a constant intensification of the search for better wear resistant materials.

Although long a classic choice, Hadfield manganese steel has been losing ground to other types of materials. Two recent modifications hold promise of regaining and expanding that market. The combination of a dispersion hardening treatment and the addition of 2 per cent molybdenum gives an austenitic steel (12-2 alloy) having good mechanical properties and improved resistance to gouging abrasion, as in cone crusher liners. A still newer development is a lean alloy, austenitic steel (6-1 alloy), which has better wear resistance than the conventional Hadfield steel but retains most of its inherent advantages, including toughness, ease of heat treatment, freedom from high residual stresses, and relatively low production costs.

Various low carbon, low alloy cast steels are giving good results in dipper teeth, ripper points, and similar parts. The low carbon adds toughness while the alloy content is sufficient to produce full hardening on water quenching and tempering. High yield strengths along with high toughness are obtained.

Pearlitic white and chilled irons have continued to be used in considerable tonnages for parts involving erosion, such as sand pumps, but an increasing percentage of the market is going to the higher alloy, martensitic, white irons, which are usually more economical on a service basis. Among the newer commercial compositions in this field is the 15-3 alloy with 15 per cent chromium and 3 per cent molybdenum. That alloy has better erosion resistance and higher resistance to moderate impact than the lower alloy materials and may even compete in certain applications where soft rubber parts or rubber liners are used.

New Markets for Magnesium Paced by Diecasting Gains

J. D. Hanawalt—Gains in magnesium diecasting consumption in 1960 were impressive—the automotive market played a substantial role. A diecast magnesium, dash panel, an instrument panel, and several smaller parts are used in 1961 model cars. Further gains are expected in the coming year.

The diecasting program is one aspect of the industry's efforts to establish new commercial and military markets to offset the decline in the military aircraft market. In the development stage are new applications for wrought products utilizing the "no-rib" principle, which offers lower fabrication costs and weight saving through design simplification and exploitation of magnesium's low density. Shipping containers are a prime example.

New products and processes are expected to be prominent in market development. A new sheet alloy requires no stress relief after welding, and another can be cold bent more sharply than previous magnesium rolled products. Magnesium precision extrusions offer the equivalent of machined tolerances (plus or minus 0.001 in). New test data show magnesium can be drawn much faster and at lower temperatures than previously supposed with economical, soap type lubricants and mechanical presses.

Zinc Outlook for '61 Hazy; R&D, Promotion Accelerate

J. L. Kimberley—Zinc usage in 1961 will depend primarily on the general level of the national economy.

Six continuous galvanizing lines for strip and sheets were added during 1960, a clear demonstration of the confidence of the steel industry in this commodity which in the past has taken more than 20 per cent of all zinc consumed.

Galvanizing of other products will continue to fluctuate with the economy. In diecasting, probabilities are not clear because of the impact of compact and economy cars. While they use zinc diecastings, they use less of all materials. Full sized cars will use more zinc on the average than before.

The zinc industry's activities in research and promotion of markets are constantly accelerating. Budgets for research and promotion have increased about threefold over the last three to four years.

Last year, early expectations of the industry were not met. Primary contributing factors included failure of automotive production to reach estimated levels, coupled with wide acceptance of compact automobiles, as well as the lower level of industry in general.

The use of zinc is inescapably tied to the fortunes of the national economy insofar as production of hard goods is concerned. It is anticipated that final statistics for the year will show zinc to have been no more affected than other basic materials for construction and manufacture.

Competition remained keen but is not known to have made any significant inroads into zinc's major markets. In the

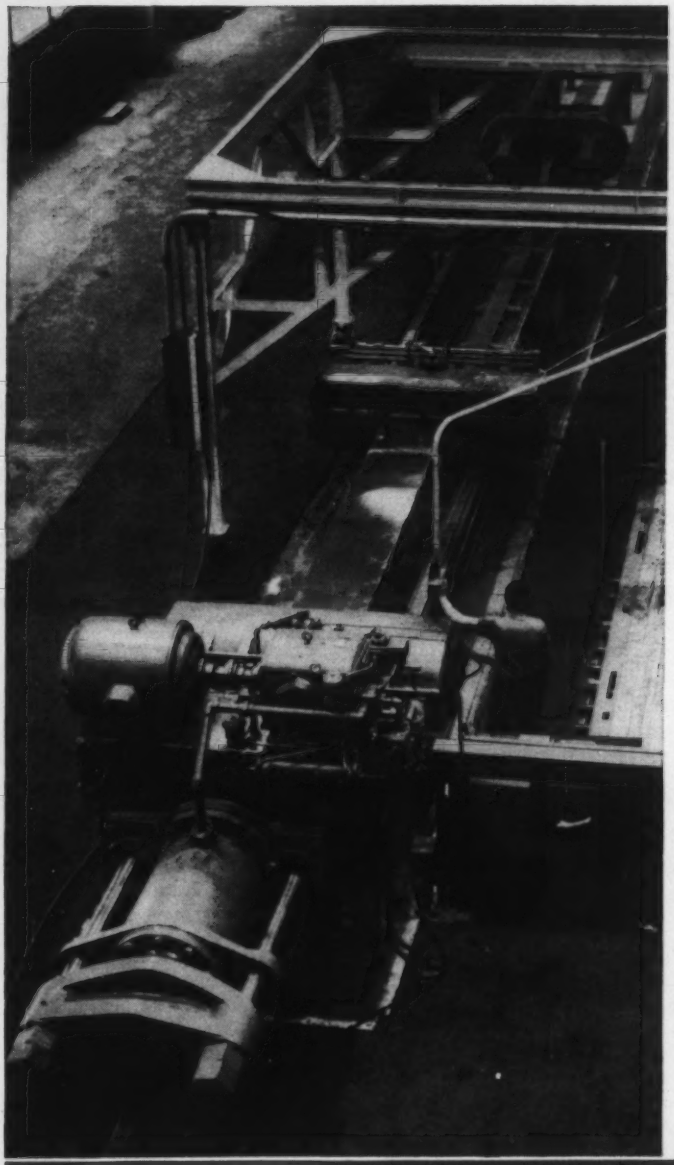

Photo courtesy of Anaconda Aluminum Company also shows Vacu-Lift equipment.

Hyde Park

STRETCHER LEVELLER

at Anaconda Aluminum Company

TERRE HAUTE PLANT

This photograph shows 375 ton leveller designed for handling sheets up to 78 inches wide by 34 feet long.

Hyde Park Levellers have a complete range of stretching capacities from 150 to 1250 tons—for levelling ferrous and non-ferrous sheets in size up to 120 inches wide by 500 inches long.

Speeds and length of "stretch" to meet all requirements.

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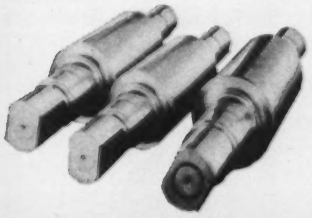

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Nickel Alloy Grain Rolls
Grain Rolls
Chilled Rolls
Nickel Chilled Rolls
Moly Rolls
Nodular Iron Rolls

All Grades Nickel Alloy Iron Rolls for Hot and Cold Rolling

ROLLING MILL EQUIPMENT

Bar Mills
Merchant Mills
Roller Tables
Stretcher Levellers
Sheet Mill Shears
Special Machinery
Sheet and Strip Mills
Pinion Stands
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CASTINGS

Furnace Castings
Heavy Die Castings
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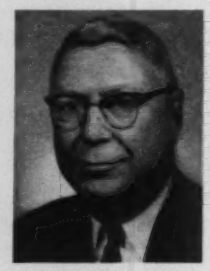
FOUNDRY and MACHINE CO.

HYDE PARK, WESTMORELAND COUNTY, PITTSBURGH DISTRICT, PA.

Nonferrous Metal Production

JERRY SINGLETON
Executive Secretary
Magnesium Association
New York



R. L. ZIEGFELD
Secretary
Lead Industries Association
New York

J. S. SMART JR.
General Sales Manager
American Smelting & Refining Co.
New York

aggregate, gains balanced losses in individual items.

The production of galvanized steel sheets, though somewhat down after June, is expected to break all previous production records. Final figures should be well over 3 million tons.

Many Industries Expand Magnesium Applications

Jerry Singleton—The past year was a relatively uneventful one for the magnesium industry. Nevertheless, progress in usage was made. Magnesium played a major role in every major missile and space program. And as the result of a new pricing situation, it found a place in the U. S. automobile industry—with this "foot in the door," an important market should open up in 1961. Growing applications in electronics hold promise for far greater tonnage, and emphasis on weight saving in all armament has focused the attention of every segment of the armed forces on magnesium.

Two developments during 1960 should help sales in 1961: 1. The achievement of suitable parameters within which magnesium can be worked on mechanical presses . . . at rates which will add impetus to efforts to win acceptance in mass production. 2. The announcement of a process for porcelain enameling of magnesium; it is expected to encourage use of the metal for many additional consumer products.

Such markets as portable hand tools, ladders, luggage, and material handling equipment promise growth. There is evidence of increased interest on the part of motor freight carriers, and acceptance of magnesium for jigs and fixtures has been outstanding. Specialized printing applications are also showing sound growth.

In England, the textile industry, farm equipment, and the Atomic Energy Authority are major magnesium users. In Germany, Volkswagen is using 90 tons a day in the foundry vs. 60 tons of iron and 40 tons of aluminum.

In 1960, primary production increased throughout the world. Wrought form shipments fell off a little, and casting shipments were down about 10 per cent—both due to the decline in defense demand and despite an indicated increase in civilian usage. Alloying consumption increased, while use in reducing operations held steady. Export tonnage has increased greatly, with every indication that it should continue at a high level.

New Ideas Expected to Expand Lead Markets

R. L. Ziegfeld—Publication by the Lead Industries Association of a report by Bolt, Beranek & Newman, acoustical consultants, provides engineers for the first time with dependable data on the use of lead as a sound barrier. Many industries are turning to lead in many forms for help in solving noise problems. A new, flexible, room divider (it's woven like carpeting and has lead wire running in one direction) is undergoing large scale field testing. Commercial use of plastics loaded with lead powder is increasing. Neoprene-lead powder combinations have been employed in several Navy ships. Interest and possibilities seem inexhaustible.

Delivery trucks powered by lead-acid storage batteries (Cleveland Vehicle Co. is producing such a truck) are being used by dairies, bakeries, and the like in several cities.

Lead zirconate-titanate (a piezoelectric material) is being used in a complete line of industrial, ultrasonic cleaning equipment. In England, a battery powered lawn mower is on the market. A similar model is expected here soon.

Porcelain enameling of magnesium has been perfected. It employs lead enamels of the type used on aluminum. Brick using lead glazes is growing in popularity for architectural applications.

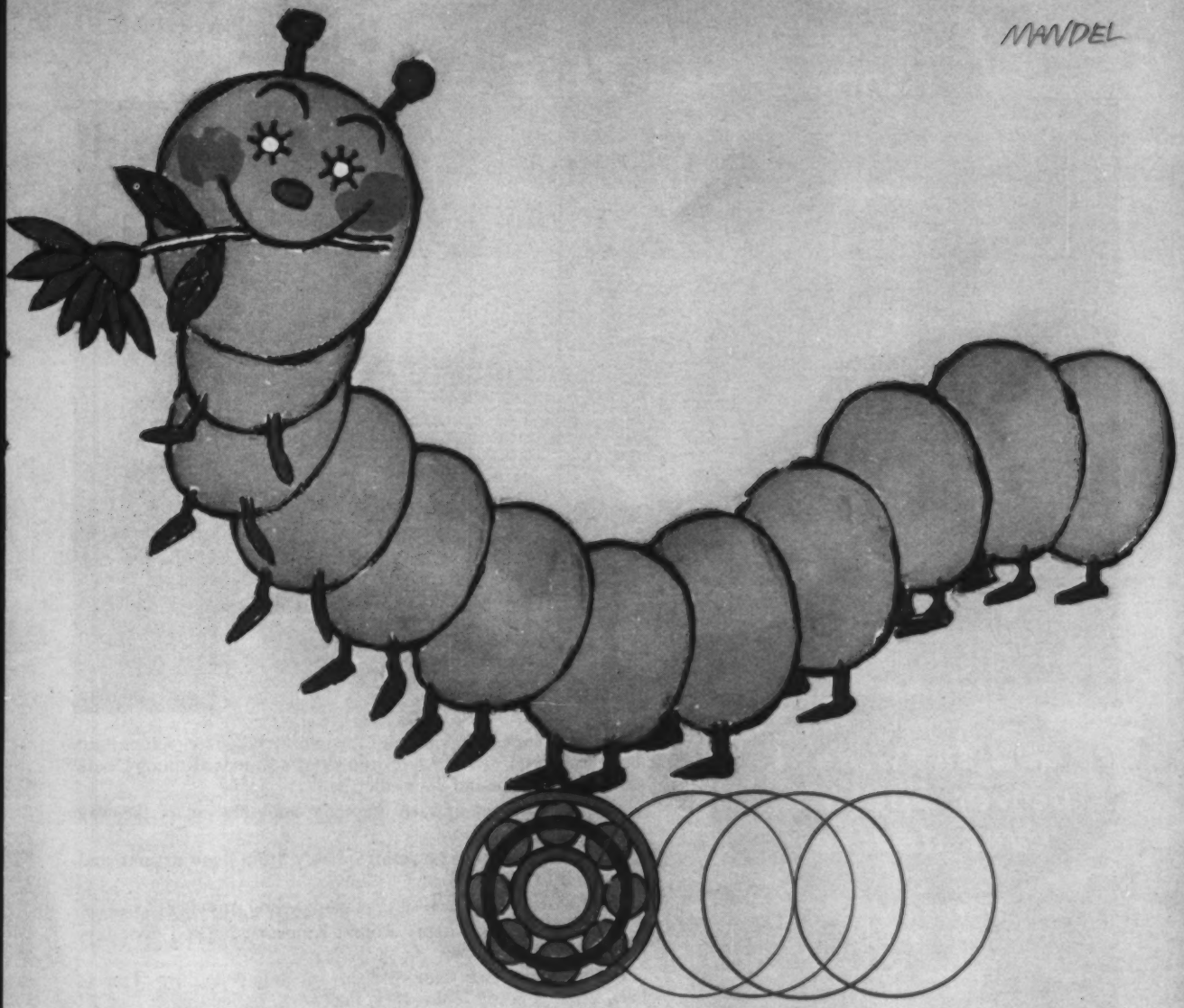
The use of lead-asbestos antivibration pads for both building foundations and machinery mounts is spreading widely in this country, Canada, Australia, England, and France.

Technology Points to Shift in Lead Markets

J. S. Smart Jr.—Prospects are that lead's markets and technology will continue to shift.

Technological changes appear to be pointing the way to new uses that will capitalize on lead's unusual properties. As the most compact and efficient material for nuclear shielding, lead is favored for all nuclear marine vessels (43 now scheduled or building) besides the more conventional atomic applications. Its high damping capacity for sound and other vibrations is gaining real product momentum as lead-asbestos pads support the columns of new buildings, or serve as machinery mounts. Lead powder or shot is combined with plastic, rubber, or other materials to serve as sound deadening layers in submarines and aircraft. Architectural products of the sound-deadening variety are planned.

In ceramics, low melting glazes rich in lead are being used as fired enamels on aluminum, and more recently on magnesium. The new lead frits can be used to glaze building blocks, tiles, and bricks in many colors. Result: Construction of maintenance-free exterior and interior walls. Another new application is the generation of useful vibrations by subjecting highly leaded ceramics to the action of an electric field (piezoelectric effect). Used in conjunction with industrial cleaning baths, the vibrations promote rapid cleansing of the objects immersed (ultrasonic cleaning). Loss of a substantial part of lead's market for cable sheathing has resulted in the development of a new method of continuous extrusion. It will permit the use of the more heat sensitive insulating materials in cable construction that must withstand the temperatures encountered in a lead press. The new press, in commercial use, eliminates the "stops" in the older process.



SMOOTH RUNNING

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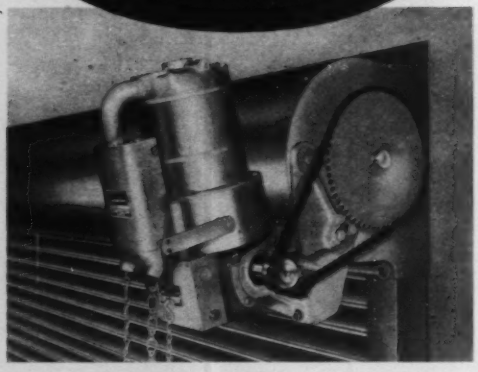

Here's compact "bonus power" for efficient rolling-door action! The New Kinnear Motor Operator permits either face-of-wall or wall-bracket mounting — vertically or horizontally — for either adjacent or thru-the-wall door control. **Thermal protection** is built-in; motor cuts out before overload damage can occur. **Centrifugal clutch** starts door action with no shock, no jolt, no stalling! New **worm gearing** extends the life of the operator-unit even beyond previous limits! **Seven sizes** assure capacities for every need. For the best possible push-button door efficiency, combine the Kinnear Motor Operator with . . .

Kinnear *invented* the door with the interlocking steel-slat curtain *more than half a century ago!* And today's Kinnear Rolling Doors still lead in all-around door efficiency!

Opening straight upward they coil smoothly out of the way above the doorway.

They clear the entire opening quickly, from jamb to jamb and from floor to lintel.

They stay out of reach of damage by wind or vehicles.

All floor and wall areas around Kinnear-equipped doorways are always fully usable.

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The tough, flexible, all-metal Kinnear curtain assures long service, low maintenance costs, extra protection against fire, wind, intrusion, or vandalism.

Heavy galvanizing (1.25 ounces of pure zinc per sq. ft. of metal, ASTM Standards) — plus Kinnear Paint-Bond — adds high resistance to weather, wear, and corrosion.

For push-button or remote-control efficiency, there's no match for the all-new Kinnear Motor Operator (optional, at left).

Kinnear Rolling Doors are built in any size. Get Kinnear recommendations on your door needs. Write the Kinnear Mfg. Co. *(Factories: 1780-1800 Fields Ave., Columbus 16, Ohio, and 1742 Yosemite Ave., San Francisco 24, Calif.) Offices and agents in all principal cities.*

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TECHNICAL PROGRESS

Casting

More strength, closer tolerances are across-the-board trends. Color anodized aluminum diecastings, improved zinc alloys predicted

New Specification Aids Gray Iron Casters

T. E. Eagan—One notable improvement on gray iron should be noted: ASTM Specification A48 has been completely revised.

Although A48 recognized tensile strength as the only way to specify the quality of the metal, it allowed the transverse test as optional. The new specification has removed this optional test. ASTM Specification A438 has been issued to cover it for those who still wish to use it.

Two other features of the specification are noteworthy: Size effect on tensile strength is recognized by requiring that the user specify the size of test bar required. A shorter test bar has been designated (9 in. long instead of 21 in.).

Malleable Iron Producers Make Competitive Moves

Price B. Burgess—Malleable iron producers will make two moves of competitive significance during 1961.

The first will be into market areas in which malleable irons are not presently important. The new areas will be opened up by high standards of metallurgical control and a wider knowledge of the physical and mechanical properties of ferritic and pearlitic malleable. Exacting control standards have made possible the entry of pearlitic malleable into the ordnance field, for example.

The second move: Broadening of the product line of the malleable industry with the introduction of new cast materials previously outside the reach of the process limitations and properties of conventional malleable and pearlitic.

Developments Permit Greater Accuracy in Casting Parts

Harry W. Dietert—Engineers can now obtain desired strength by cross-sectional design, employing light metal thickness and correctly designed ribs and contours. The strength used to be achieved by using heavy sections. Cross-sectional design not only reduces weight and improves grain structure with a great gain in strength, but it also has provided an opportunity to apply new methods that produce castings that are accurate in size and true in contour.

With the core actually set or cured in the machined corebox, the core is true to dimension. In addition, such cores are often nearly twice as strong as conventional cores and possess exceedingly high hardness on the surface.

Both high strength molding sands and ceramic precision molds make it possible to produce cast parts of high accuracy. The latter method finds good use in casting the hard-to-machine metals into cast parts that require little or no machining.

Casters Aided in Reaching Quality, Reduced Cost Goals

C. V. Nass—In the sand-cast foundry industry, quality improvements and cost reduction will continue to get increased emphasis. Several recent technological advancements are being proved in pro-

Casting

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JOHN L. MacLAREN
Chairman, 1st Nat'l Diecasting Exposition; Representative Aluminium Ltd. Sales Inc., Detroit

D. L. LAVELLE
Central Research Laboratories
American Smelting & Refining Co.
South Plainfield, N. J.

duction to help the foundryman achieve those goals.

Shell molded castings have about found their sphere of application, but hollow shell cores offer the foundryman many advantages and opportunities for cost reduction and improved quality in either green sand, dry sand, or shell molded castings. The use of hollow shell cores will continue to develop rapidly, and new, larger equipment to allow the broadening of their field of use is now available.

The application of furfural or hot-box process cores is eliciting much interest and will continue to develop. More high production units will be in operation in 1961.

True mold blowing, where molds are blown to their required uniform hardness, is still in the research and development stage, but should emerge into the production stage during 1961.

Ceramic Shell Improvements Pave Way to Progress in '61

Stuart Z. Uram—This will be a year of great progress for the investment casting industry because: 1. The ceramic shell technique has reached technological maturity. 2. Research should yield improved mechanical properties in cast metals.

The ceramic shell technique permits complex shapes in the 5 oz to 50 lb category to be economically cast with the precision and surface quality of the lost wax process. Designers of metal parts will have greater freedom through the application of the process; many components which were previously fabricated and assembled may be cast in a single unit with considerable cost saving.

The quality aspect of investment castings is being pursued by research programs in the solidification behavior of metals in hot molds. Investment casters are investigating many facets of quality control to insure the dependability of their products. Evaluation of the properties of the casting as well as results of tensile testing are being stressed. Studies of heat flow should enable investment castings to control and perhaps increase casting mechanical properties. That should enable investment castings to possess mechanical properties equal to their wrought counterparts.

DIECASTING

Technological Exchange Can Open New Diecasting Markets

Joseph G. Rayniak—Free, unrestrained trading of technological skills among U. S. competitors and friendly foreign firms will help strengthen the diecasting industry and open avenues to new markets and new products.

The diecasting industry as a whole is still in its infancy. Untold rewards await those in the automotive and other consumer product fields who are bold enough to venture forth and tap hidden resources.

For example, we have replaced art in diecasting with science; we did this in various ways, including: Installation of electric induction furnace, solid frame, diecast machines which made possible the production of large diecastings with excellent density; and more rugged dies of finest tool steels.

Diecasters Predict Upturn In Markets This Year

John L. MacLaren—Output of zinc and aluminum diecastings is expected to advance at least as much in 1961 as in 1960. Last year, an estimated 8 per cent tonnage increase over 1959 was registered for zinc, 12 per cent for aluminum. The main consuming industries will again be automotive and home appliance, with automotive taking a larger share. Brass diecasting output will remain at about the same level as in 1960, but magnesium tonnage, responding to aggressive producer promotion, should more than double.

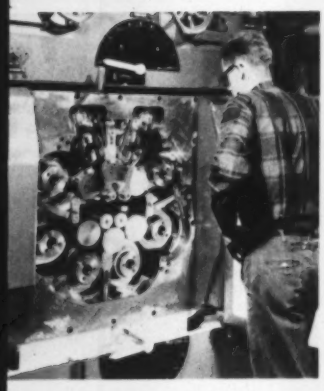
Several major innovations in diecasting machine design are scheduled for introduction, including large platen, low injection pressure equipment; vertical machines engineered around automation concepts; and units with higher locking tonnages. Castings will be larger and more complicated. Another diecast engine block will be offered. Wider use will be made of die temperature control, vacuum and vibration techniques; also automatic ladling, lubrication and casting removal.

NONFERROUS

Trend to Aluminum Castings Brings Technical Needs

D. L. Lavelle—A marked increase in the consumption of aluminum by the automotive industry was made this year with the introduction of aluminum engines, which included the first commercial production of diecast engine blocks. Other cylinder blocks are produced by conventional, semipermanent mold practice, and also by a process relatively new in this country: Metal is forced up into the mold from a pressurized holding furnace. The aluminum engine block castings are all in conventional alloys. The hypereutec-

Superior's new SENDZIMIR Mill



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It's not what you pay for solvent. It's how long your solvent keeps working between degreaser cleanouts.

WHAT'S PSP? It means "permanent staying power." It's what you get with Nialk TRICHLOR. The stabilizer in this solvent doesn't wear out. You don't need to add fresh stabilizer when you degrease with Nialk TRICHLOR. You don't have to check the pH. The stabilizer stays with the solvent and keeps on protecting it. In the bath. In the vapor. Even after repeated distillation.

WHY IS PSP IMPORTANT? Users report substantial savings with this better, more stable trichlorethylene. Degreasers run without shutdown for weeks—even months longer between cleanouts, in many cases. Rejects are down sharply. Less solvent is needed, because less goes down the drain in unnecessary cleanouts.

To start saving in your plant—soon—see your Nialk TRICHLOR distributor. He can show you why your best buy is the solvent that doesn't wear out prematurely. Call him today.

NEW 36-PAGE BULLETIN explains fully how you get more and better vapor degreasing for the money with Nialk TRICHLOR. Shows basic types of vapor degreasers. Discusses cycles, operating procedures, stabilizers, causes of solvent contamination, solvent recovery, trouble shooting. Ask your distributor for a copy or write us.

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Casting

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Vice President
Apex Smelting Co.
Cleveland

HARRY M. ST. JOHN
Foundry Consultant
Ft. Pierce, Fla.

HERBERT F. SCOBIE
Executive Secretary
Non-Ferrous Founders' Society
Evanston, Ill.

tic aluminum-silicon alloys containing about 20 per cent silicon (they have excellent wear resistance) have not found much use because of poor casting properties.

There is great interest in the production of color anodizable, aluminum diecastings. The advent of vacuum techniques has helped, but the industry is still searching for better alloys, the most promising of which are based on the Al-4 per cent Zn and Al-4 per cent Mg systems.

Mechanization Aids Nonferrous Founders

Elmer G. Brumund Jr.—Perhaps the most basic evidence of a trend toward better facilities in the nonferrous foundries is the growing mechanization to achieve higher product quality and uniformity, and to develop greater productivity to offset increasing labor costs.

Mechanization growth was dramatically illustrated in a recent Non-Ferrous Founders' Society cost study which shows overhead claiming a higher proportion of costs over the last five years while labor, even though wages have gone up, represents a decreasing proportion of costs.

Among specific technological trends is the increased use of shell cores in both sand and metal molds. That is coupled with greater interest in synthetic sands and in special molding materials and techniques such as waterless binders; olivine sand; and carbon dioxide, sodium silicate, bonded cores and molds. Overall, there is and will continue to be greater attention to sand and mold control for green sand work.

Melting departments are getting serious attention and there is increased use of high frequency induction melting to achieve flexibility and speed. More foundries are installing low frequency, induction furnaces to handle long run, high production work.

Engine Blocks Provide Big Lift for Aluminum Castings

D. L. Colwell—The big news in the aluminum casting industry is the use of aluminum alloys for automobile engine blocks.

Several cast aluminum parts are on automobiles today: The aluminum crankcase and cylinder heads connected by steel sleeves as used in the Corvair, the slant type engine parts as used in the new Chrysler line, and the diecast engine blocks in the Rambler. Some of these parts are sand cast, but the trend is toward permanent mold castings and diecastings. Undoubtedly, the next few years will see a wider use of aluminum castings in this area.

There is much talk about aluminum diecasting alloys which can be anodized. Silicon in diecasting and permanent mold casting alloys is almost a necessity to secure suitable casting properties. Silicon in an aluminum casting does not lend itself to a clear or light color anodizing process. In some instances, the vacuum diecasting process has helped to cast siliconfree alloys and it may be that by the wider use of vacuum diecastings, anodized aluminum castings will become more common.

Brass and Bronze Foundries Face Economic Challenge

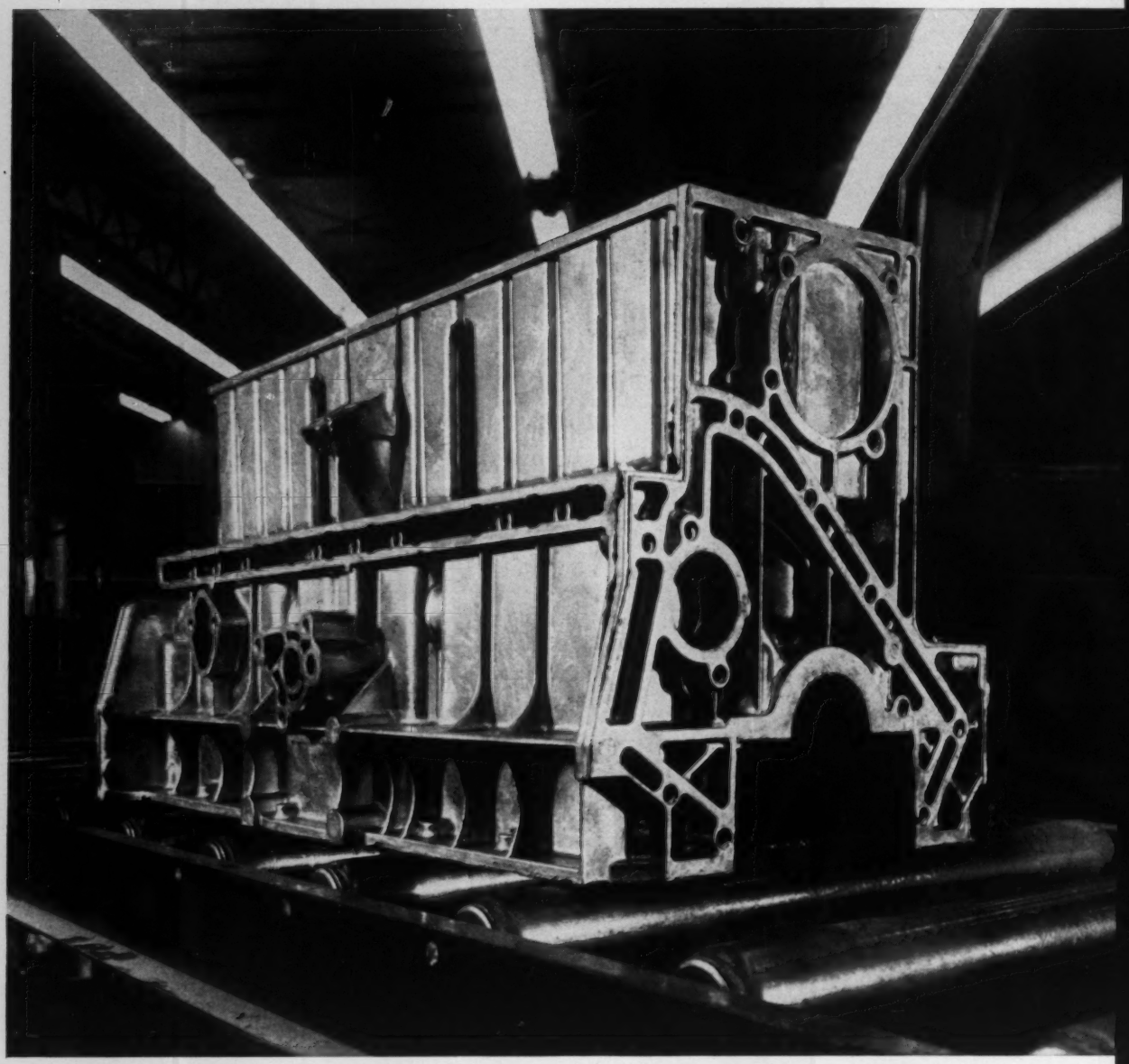
Harry M. St. John—Because of the increasing cost of labor, the handling of metal, sand, molds, and castings must be mechanized if the foundry is to be competitive. The foundry must also take advantage of recent technical advances which improve quality and decrease cost. To meet these needs requires a substantial capital investment, a requirement which the small foundry finds difficult to meet.

Small captive foundries, faced by an expense out of proportion to their volume, will either discontinue operation or, for the sake of convenience, decide to operate at a loss. Large jobbing foundries will find it necessary to make the investment required by modernization.

Nonferrous Casters Quicken Marketing, Production Pace

Herbert F. Scobie—Nonferrous foundries will continue to emphasize two fundamental lines: Improved production facilities and markedly stepped up marketing and sales efforts. The market, particularly for cast brass and bronze, is not developing as it should. Another factor is the interest of manufacturers outside the nonferrous industry are showing in the establishment of aluminum foundry facilities.

Nonferrous foundrymen will strive to satisfy their curiosity regarding competitive processes and materials. Goal is to determine why some customers switch some components away from nonferrous castings. The upsurge in marketing, particularly among copper-base foundries which have been hit harder, will lead to greater imagination in selling, to product development, to promoting sale of cast, nonferrous alloys on the basis of merit rather than tradition, to greater emphasis on engineering, manufacturing, and consumer advantages.



World's first die-cast aluminum "six"

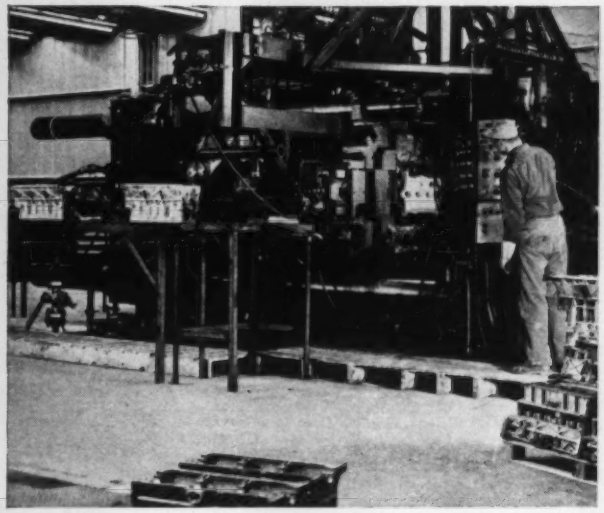
Saves 80 pounds for American Motors' new Rambler Classic . . . incorporates specially bonded cast iron liners in dry sleeve design.

This engine block is the biggest die casting ever mass produced. It's the world's first six-cylinder block for passenger car use to be die cast in aluminum.

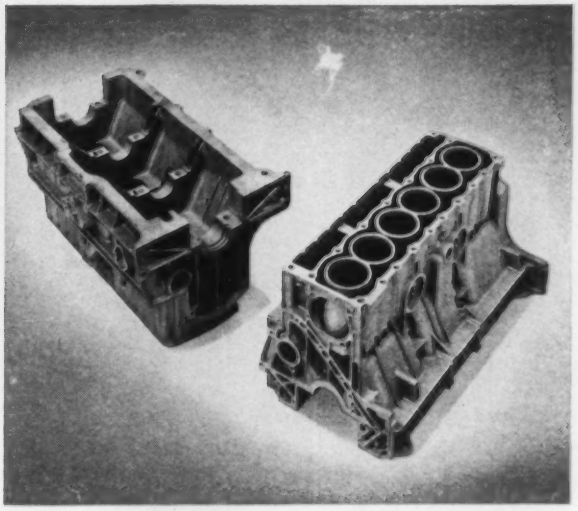
It's a 67 pound lightweight including 14 pounds of centrifugally cast iron cylinder liners. That means a total saving of 80 pounds deadweight . . . now standard in the new Rambler customs, optional in other Rambler models.

Light but strong. Aluminum's excellent physical properties are fully utilized by careful die cast design and photostress analysis. Outstanding strength, soundness and precision provide a big plus for heavily-emphasized Rambler quality.

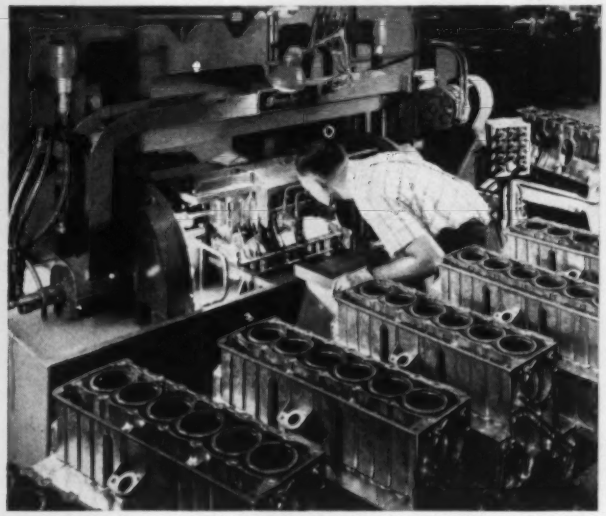
BMI bonding is simple and sure. The BMI—or Bi-Metallic Interlock developed by Doehler-Jarvis—mechanically "anchors" the liners by means of their specially prepared cast surfaces. Since these liners are centrifugal castings, no knurling, crimping or splining is needed. An intimate locking action occurs as the molten aluminum is injected into the die . . . under 8,000 psi. The result: an inseparable bond with excellent heat-transfer properties.



A block every three minutes . . . from 2,000 ton machines like this. In three tenths of a second, machine injects a 70-pound "shot" of molten aluminum . . . under 8,000 psi.



Centrifugally cast iron liners—up to 260 Brinell—are cast in place with specially prepared surfaces which lock inseparably with molten metal under pressure.



Pressure tightness of die-cast aluminum blocks is determined by testing on a machine specifically designed for this purpose. Advanced quality control helps protect highest standards.

Palletized for rapid delivery, these finished blocks can reach American Motors assembly plants by rail . . . or in trucks of the Doehler-Jarvis fleet.

rolls off the line at Doehler-Jarvis

To design for efficient production, American Motors and Doehler-Jarvis engineers combined specialized know-how with liberal imagination. An oil gallery for hydraulic valve lifters is an integral part of the block casting. Liner inserts and loose pieces for casting undercuts are placed by automatic attachments that never slow down the casting cycle.

To make new ideas pay off, perhaps you can use the facilities, resources and practical experience offered by Doehler-Jarvis. Eight plants provide the capacity—and the flexibility—to serve large companies well, and to help small ones grow. For detailed information, simply phone or write the nearest Doehler-Jarvis plant or office.

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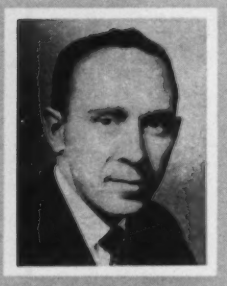


K. H. ROLL
Executive Secretary
Metal Powder Industries Federation
New York

TECHNICAL PROGRESS

Materials and Metallurgy

Improved processing widens service range of conventional materials; interest in exotic materials continues to grow

Refractory Metals Must Meet Higher Specifications

F. C. Eddens—The use of the more corrosion resistant materials, such as titanium, tantalum, and zirconium, will increase rapidly as the cost of fabrication is reduced.

There will be a continued, more exacting, demand by the military and space agencies for refractory metals possessing high strength to weight ratios. Much past work in this field has been exploratory and any encouraging results were welcomed. In the future, products will need to meet more exacting physical and dimensional requirements.

There should be an increased effort in the new strengthening mechanisms for metals.

Lower Inventories to Spur Tool Steel Production

W. G. Dahl—Tool steel producers, with their production output generally geared from six months to a year ahead of the rest of the nation's industry, look for marked improvement in schedules during the first quarter, with still further increases by the middle of the year.

Tool steel inventories are down in the automotive, appliance, and fastener industries—large volume users of metals produced by this segment of the steel industry—and engineering design changes for 1962 models in cars and appliances are well underway.

There are about 16,000 components in today's cars, each dependent upon tool steels. It's estimated 7½ lb of tool and die steel are used for each car (1961 estimate: 5.7 million units). There is plenty of volume for the tool steel producers.

We must look for increased quality in the entire product line, offer new alloys, and sell service as well as the product.

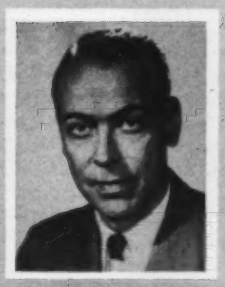
Predictions Put into Action Can Level Business Cycles

C. L. Hardy—How to eliminate severe inventory fluctuations and thereby reduce the peaks and valleys in production is perhaps the most pressing problem facing industry today. It has a bearing on the lives and fortunes of all.

The steel industry is in the fortunate position of having fewer levels of distribution than most industries. But no one, however, is more aware of the impact of inventory fluctuations than the steel producer. Although the general line, industrial steel service center pools the requirements of customers from diverse industries, it too has an inventory problem and is confronted with the challenge.

The problem is twofold, and interdependent: 1. We must learn to rely less on past performance in our decision making and instead predict inventory buildups and declines. 2. We must then have the courage to take action such as cutting back on inventory replenishment in the face of continued high demand when our evalution indicates demand is approaching a peak.

In carrying ou. these functions the manager of the future must be a true professional.



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Vice President-Operations
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Pittsburgh

C. B. POST
Vice President
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Continuous Shapes from Metal Powders Coming

K. H. Roll—Forming of sheets, tubing, and strip on a continuous basis from powders will almost certainly become a commercial reality in the 1960s. Work is progressing on the continuous compacting of all types of metal powders into billets for further working. Definite economies have been shown in the manufacture of strip directly from copper powder, bypassing all melting operations. High purity, nickel strip is being made by this method. Tubing is being produced commercially from copper powder.

The advantages of copper strip and tubing from powder are lower cost, higher purity, and closer control over properties. Metal in powder form can easily be manufactured to extremely high purity which can be maintained throughout the process, uncontaminated by melting.

Dispersion strengthened materials, a relatively new field for powder metallurgy, have so far matured into production items only in the sintered aluminum powder and nuclear materials areas. Uranium oxide-stainless steel powder control and moderator rods are commercial examples of dispersed phase structures.

Design Plays Key Part in High Strength Metal Use

G. K. Manning—The vast amount of study that has been devoted to high strength metals will pay increasing dividends during the next few years. Look for the successful application of steels that are in the 400 to 500 ksi strength range. The primary motivation has been space travel, but a weight penalty is associated with every structure that must be transported or moved. The trend will spread to an ever increasing number of manufactured parts.

Lighter weight requires materials of greater strength, but since it is almost a truism that greater strength means less ductility, progress is dependent upon the design engineer and the manufacturer as well as the materials engineer. New design concepts help to distribute the load and reduce stress concentration. New fabrication procedures such as high strain rate deformation techniques, spin forming, and new welding and brazing methods can lead to greater perfection in the finished part. Improvements in nondestructive inspection techniques permit the manufacturer to guarantee a smaller maximum flaw size.

Stainless Applications Continue Steady Growth

R. E. Paret—Uses for stainless in industrial and consumer products continue to accelerate at rates up to eight times greater than those of other basic materials of construction. Part of the gain results from increased familiarity with the alloys and part from their versatility.

Cold rolled, austenitic, stainless alloys now available can develop up to 290,000 psi with special treatment and prove entirely suitable at temperatures to 800° F. Ultracold rolling (at temperatures below −100° F) is found to greatly increase tensile strength.

Ductility of stainless at subzero temperatures explains its current appeal to cryogenic, rocket, and missile engineers. All recent oxygenmaking plants (many intended for oxygen steelmaking) employ vast quantities of inert stainless, and several appear to have standardized on autstenitic stainless alloys.

The automotive industry continues as a major user of stainless steel. Some powerplant designers suggest the metal may find its future in the engine compartment.

Emphasis on curtain wall construction, with need for little or no exterior maintenance or cleaning, is responsible for architectural interest in stainless.

ALLOY AND TOOL STEELS

Costs to Govern Gains In Vacuum Processing

W. E. Gregg—The technical challenge of the future is to bring the dramatic improvements in metallurgy to the users of special metals at proper costs.

For example, a few years ago, we talked of high strength steels at 100,000 psi tensile and high strength titanium alloys at 120,000 psi. Now, we are producing vacuum melted alloy steels with strengths of 200,000 to 300,000 psi, and titanium with usable strengths of 180,000 to 200,000 psi. Our job will be to produce those excellent quality metals at lower costs for broader markets.

One interesting step in improving the quality of alloy steels at minimum increased cost is the vacuum degassing treatment unit now in operation. Addition of alloying elements under vacuum allows closer control of composition and reduces inclusions. The unit should reduce the oxygen and the hydrogen levels to a marked degree and remove a significant quantity of the nitrogen. It is capable of effectively treating a 170 ton heat of open hearth steel in about 30 minutes.

New Tool Steels Ease Wear Problems

C. B. Post—This year will seee a stronger trend toward use of air hardening tool steels. New grades will be available with superior properties. Two new tool and die steels which can be air hardened from

Materials and Metallurgy

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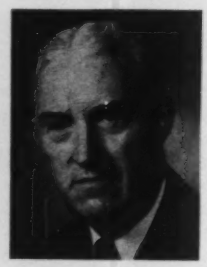

R. L. WILSON
Director of Metallurgy
Timken Roller Bearing Co.
Canton, Ohio

1550 to 1600° F will be marketed.

The lower hardening temperature for the new steels means, in most instances, that the same heating furnaces can be used as those employed with oil and water hardening steels. Furthermore, hardening at the lower temperature minimizes the danger of decarburization present at a higher range.

One of the new steels will have better wear resistance than that offered by the standard, high carbon, high chromium steels. Field tests showed its size change and warpage perceptibly lower than AISI Type D-2 and it demonstrated an average 100 per cent improvement in service life.

The second new air hardening tool steel is exceptionally tough, having notched-bar Izod impact values of 10 to 14 ft-lb at hardness of Rockwell C-59 to 60. Size change during heat treatment is about 0.0003 in. per in. Applications for this grade will be found in tools and dies that fail by fracture rather than wear.

Civilian Uses for Specialty Steels Expected to Gain

K. D. Mann—The powder metallurgy of refractory metals (such as tungsten, molybdenum, and their alloys) has become much more important with increased emphasis on space technology. This year will see marked advances in the production of pressed and sintered tungsten and molybdenum components for direct use in missiles and rockets, as well as billets and preforms of those materials for working by forging, spinning, and other methods.

Specialty steels developed for Space Age use continue to challenge the metallurgical resourcefulness of alloy steel producers. They must meet ever increasing performance requirements, and can serve for critical application in other fields.

High temperature and high strength materials will continue to be used for years to come in jet and turbo-prop aircraft. Certainly, specialty steels will find increasing use in gas turbines for power and propulsion. Superquality engineering alloys, possessing ultrahigh strength combined with good transverse ductility and unusual cleanliness now used for motor cases in rockets and missiles, are finding increasing civilian applications.

Finally, new horizons for high quality materials are visible for the generation of nuclear power.

Bright-Annealed Stainless Moves into High Volume

W. B. Pierce—Bright-annealed stainless steel came to market in volume for the first time late in 1960. It will rank as a sparkling newcomer to the 1961 models of autos as well as other metal products. It also shows how makers of special steels move to meet the ever-changing needs of industry.

In this instance, the automobile industry needed improved corrosion resistance in decorative trims, in a metal that would retain its bright finish during fabrication and which required a minimum of buffing and polishing. Bright-annealing—a process used on limited quantities of special alloys at relatively high cost—appeared to offer a solution.

Leading stainless producers and makers of annealing equipment began a move to find a practical continuous process for bright-annealing strip for high tonnage production at costs comparable to conventional stainless. It led to new vertical furnaces for continuous bright-annealing.

To meet competitive demands, most major stainless suppliers will invest the necessary capital and install the required equipment to supply the new product.

This is a classic example of how our customers gain. Alert producers of special metals seek to anticipate the present and future needs of their customers.

Low Alloy Steel Has Good Temperature Resistance

R. L. Wilson—The quest continues for stronger, low alloy, martensitic steels for service at higher temperatures. Ease of shaping, machining, and treating as well as economy has made those steels widely accepted for high strength-high temperature applications.

A new steel of low total alloy content extends the possibilities of the martensitic engineering alloy steels to higher strength and temperature levels. It was designed for structural and machinery applications up to 1100° F, with strength properties and heat treatments adjusted to the service conditions.

It may be oil hardened and tempered to give as much strength at 1100° F as is ordinarily found at 1000° F in similar steels for such purposes. When best hot properties are wanted, the steel is air quenched and tempered to obtain unusually high rupture strength.

Intricate parts of large or small size can be produced with minimum distortion and residual stress. That is done by air quenching to an intermediate hardness of about 42 Rockwell C, permitting the performance of all machining operations to manufacture a part, then utilizing the secondary hardening capacity to raise the hardness to as much as 52 Rockwell C.

Growth Seen in Applications Of PH Stainless Steels

M. E. Carruthers—While the precipitation hardening stainless steels are best known for their strength at supersonic flight temperatures, the growing civilian use of 17-4 PH (Armco) stainless steel during the last year has been particularly noteworthy. Trends point to substantial further increase in demand.

A new concept is based upon fabricating the steel in a semihard metallurgical condition. If needed, further hardening

Materials and Metallurgy

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at low temperatures in the range 850 to 1150° F is possible. Steps in manufacture have often been reduced by half.

Corrosion resistance is superior to the martensitic stainless steels and comparable to AISI Type 304 in most media. So 17-4 PH is replacing the standard industry types where its higher strength and better wear and abrasion resistance assure improved service performance, in areas such as chemical and food processing, cryogenics, nuclear equipment and marine products.

HIGH TEMP ALLOYS

New Alloys Sought For Higher Temperatures

M. N. Ornitz—Development trends in high temperature alloys continue unchanged in direction. Automation in heat treating necessitates longer alloy life, more intricate and precise castings, and stronger materials. Although commercial high temperature alloys have made feasible heat treating at temperatures up to 2300° F, the demand for even higher temperatures and stronger alloys remains unabated. Much research seeks alloys of molybdenum, tungsten, or columbium to take advantage of their high hot strength. The problem has been to provide high temperature oxidation and corrosion resistance.

In the intermediate temperature ranges such as 1600 to 1800° F, new alloys have been developed to replace standard 35 per cent nickel, 15 per cent chromium material. Those alloys provide higher strength, better resistance to thermal fatigue, better surface stability, and resistance to carburization, as well as lower cost.

A continuous development program must be maintained to take care of the rapidly changing technology of industry.

Next: Nickel Base Alloys For Higher Temperatures

T. E. Kihlgren—Most recent nickel base alloy developments have been in the field of high temperature metallurgy. The need for higher temperatures for improved efficiency in gas turbines provides a major stimulus. Nickel base cast alloys have been developed with a temperature capability of 1850 to 1900° F, about 50° F above previously available materials, and an additional 25 or 50° F may yet be realized.

Temperature capability of the wrought nickel base alloys is improved through the use of special melting and hot working techniques. A number became commercially available in the last year.

Dispersion hardening of nickel with a refractory metal oxide such as alumina, using powder metallurgy techniques, may ultimately provide usefully strong nickel base alloys up to possibly 2200° F, but much development work still has to be done.

At intermediate temperatures of the order of 1200 to 1400° F, new alloys offer long time structural stability and ready fabricability. Such alloys may be useful in 1150 to 1200° F steam applications and for some nuclear applications, with immunity to stress corrosion cracking. In the field of hot corrosion, nickel-chromium alloys containing around 60 per cent chromium are arousing interest.

The vacuum melting process, both induction and vacuum arc, continues to play a vital part in the technology of the gas turbine alloys. Research underway in nickel base alloys seeks to understand more completely the mechanism of high temperature strengthening and the role played by subversive elements, often in the order of relatively few parts per million.

A new "20 to 25 per cent nickel steel" combines age-hardening with a mechanism similar to martensitic hardening. The new approach has yielded materials combining room temperature strength and toughness equal to or better than the best of the quench and tempered alloy steels. More importantly, it has a greater potential for further enhancement of properties.

Reactive Metal Processing Uses Inert Atmosphere

C. T. Evans Jr.—Vacuum melting techniques have permitted manufacture not only of improved qualities of iron, nickel, and cobalt base alloys but also large ingots of refractory metals such as molybdenum and columbium. Pure molybdenum ingots up to 16 in. in diameter, weighing 5500 lb, and sheets up to 48 x 105 x 0.060 in. have been made.

There are still many problems in trying to fabricate high quality mill products from the refractory metals and also from the reactive metals, particularly the superhigh strength, titanium base alloys. They have the unfortunate combination of high melting points and either poor oxidation resistance or high susceptibility to embrittlement by the gases present in the normal atmosphere. Accordingly, an inert atmosphere fabrication pilot plant will work refractory and reactive metals at the optimum forging and rolling temperatures near 80 per cent of their melting point. That means heating, forging, and rolling above 3000° F in an atmosphere so pure that neither oxidation nor

embrittlement will take place.

Most of the equipment within the argon filled room is operated by remote control. Airtight, air-conditioned space suits are provided to perform manual operations.

Currently, the facility is in the initial pnase of training operators and testing the equipment. The room may provide the ideal conditions for hot forming and for welding complicated or heavy structures in both refractory and reactive metals, and may make new alloys practical.

Research Will Yield Stronger Refractory Metals

D. V. Doane—New uses of molybdenum in iron and steel are accepted as a matter of course, whereas new developments in refractory metals make news. Molybdenum-base alloys are now available which will withstand stresses well above 10,000 psi at 2400° F for 100 hours before rupture. Intensive research promises to yield even stronger and more refractory metallic materials. Alloy development is already ahead of our fabricating ability which will inevitably be emphasized.

Many organizations are engaged in fundamental studies of plastic flow and ductile-brittle transition behavior. The influence of metal purity and consolidation techniques on ultimate hardness and ductility is being studied.

Wide, high ductility, 60 mil sheets can be produced from the highest strength commercially available molybdenum-base alloy.

During the last year, forged unalloyed molybdenum rings as large as 15 in. OD by 1½ in. wall have been produced which exhibit significant ductility at room temperature.

These developments contribute to the establishment of the new technology for the refractory metals, with their exceptionally high strength at high temperatures, high modulus of elasticity, and unique chemical characteristics.

Columbium Use May Top All Other Refractory Metals

W. R. Hibbard Jr.—New and exciting developments in materials and metallurgy will arise in at least two areas—higher temperatures and electronics. In the high temperature area, all refractory metals will be used, but an outstanding one appears to be columbium. Its oxide is not as volatile as that of molybdenum, and therefore offers a somewhat better chance of protection. Columbium—by far the most abundant refractory metal—possesses remarkable properties. At low temperatures, it possesses the highest superconducting transition temperature and critical field of any pure element. In the lower temperature ranges, columbium resists steam and hot water corrosion. Its low neutron cross section and corrosion resistance make it an attractive nuclear structural material.

In the electronics areas, small but precisely controlled bits of material will play large roles, as will low temperatures. Example: The new tunneling discoveries through a thin film dielectric between two superconducting metals at cryogenic temperature, to produce devices that offer small size, low power requirement and low cost.

Reduced Failures Result From Vacuum Melting

C. E. Roberts—The innovations of the space and atomic ages are causing a technological revolution in the steel industry. Steels now must perform at temperatures varying from −420 to +2000° F, and under many different environments.

Fatigue, impact, and corrosion failures under these varying conditions can usually be traced to a crack which propagates.

Vacuum melting has given the industry a tool to produce cleaner and more precisely controlled steels. Results to date indicate that at least some of the crack propagation problems will be solved by this tool.

Vacuum technology will permit development of previously impossible alloys, and lead to new steels to meet the tougher requirements.

ALUMINUM

Aluminum Gain in Autos, Building Products Predicted

J. R. Willard—Probably no other peacetime era in the field of aluminum metalworking has witnessed greater emphasis on technological progress.

A new, quick opening, aluminum can features an aluminum end tab which removes the entire can top in one quick motion. It is adaptable to aluminum or tin plate can bodies. Introduced as a companion to the tear-top was a container body formed of aluminum foil laminated to both sides of a paperboard base.

Converters, who process aluminum foil and other products into packaging will benefit from the adoption of equipment which splices the ends of foil rolls with high frequency sound waves. The ultrasonically spliced foil means cost savings

Materials and Metallurgy

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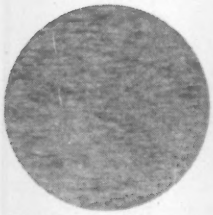
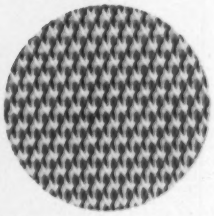
If you made aluminum crust for apple pie which would be best to use?





PLAIN OR PATTERNED? To help you decide, send for free sample kit of Fairmont embossed pattern sheets now putting new sales appeal into everything from awnings to truck bodies. Fairmont offers truly wide range of alloys, tempers, gauges, finishes. Write Dept. 37A, Fairmont Aluminum Company, Fairmont, West Virginia.

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MORAL: before final buying decisions are made, consult with a Fairmont field engineer. His mature and varied experience among aluminum fabricators makes him a whiz at application ideas that help you buy profitably. And he's backed by the aluminum source, according to a recent survey, that rates first for fulfilling promises and commitments.

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Supervisor
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G. WIENER
Manager, Magnetics Dept.
Research Laboratories
Westinghouse Electric Corp.
Pittsburgh

because it permits higher speeds on production and reduces waste involved in removing splice sections.

Building applications of aluminum lead all other end-use products. Advances in sheet forming and coating techniques spurred the use of residential aluminum siding. Progress is being made in the development of a practical and aesthetically desirable roof system for residences, and a new Bermuda-type shingle is proving popular.

Gains in the automotive field were also significant during the last year. Noteworthy advances included widespread acceptance of aluminum engines, now available in five 1961 models. Aluminum wheels, in which the brake is cast as an integral part of the assembly, greatly improves the braking power of today's automobile. Exterior applications of aluminum also are coming into their own, with bumpers, trim, radiators, and a host of other items predicted for the future. We feel this is merely a prelude to aluminum equipment that will be standard on the automobiles of tomorrow.

Advanced Processes Benefit Many Users of Aluminum

B. E. Brennan—Sophisticated practices will be more and more common in aluminum fabrication during 1961.

Vacuum diecasting—a production method for producing high quality surface and structure in aluminum parts—achieved substantial acceptance during development. A bright future can be predicted for the process in both functional and decorative aluminum diecastings. First major uses are expected in automobiles, appliances, and hardware.

Adhesives, sealants, and coatings are important in making many new aluminum products. Benefits include new markets for aluminum and plastics, economies in manufacturing, and greater satisfaction in service.

Prefinished mill products—particularly coiled sheets, prepainted in durable permanent enamels—have already provided manufacturing economies. Those convenient materials can be expected to find many more uses and users. A prefinished, formable metal in coils slit to exact width eliminates many operations and materials, and provides maximum operating economies.

MAGNETIC MATERIALS

Research Stepped Up to Meet Wider Requirements

G. Wiener—During the last few years, research in magnetic materials has centered on such diverse fields as power generation and distribution, computers, high temperature application, and permanent magnet devices. In 1961, significant material developments in each of those areas may be forthcoming.

The long sought development of cube textured silicon iron in commercial quantities should begin to have an impact in the field of electrical power generation and associated devices.

In the field of computers, thin metal magnetic films for memory storage units hold promise for faster switching times and less temperature sensitivity. The range of iron-cobalt alloys for high temperature use has been expanded to include improved alloys from 27 to 50 per cent cobalt. New ceramic permanent magnets for electrical and electronic applications are resistant to demagnetization and can be used in short section.

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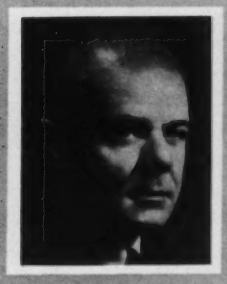

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TECHNICAL PROGRESS

Heat Treating

Higher temperatures, changes in automation practices are coming trends in heat processing equipment, experts predict

Depreciation Policies to Affect Speed of Progress

R. E. Fleming—The manufacturing industries can expect outstanding technological improvements in heating equipment as we proceed into the sixties.

The great challenge to the design and engineering brains of our industry: Conceiving workable new processes and the task of designing suitable equipment. Our industrial heating equipment industry has already had a taste of this new work and has been most successful in meeting Space Age requirements.

Each new, successful space probe, we can be sure, will define additional metallurgical problems.

In the more conventional heating fields, industry can expect equipment capable of much greater output with significantly reduced operating and maintenance costs.

Also significant will be greatly increased uniformity of output. That will be achieved through closer control of temperatures by improved fuel and air control, measuring and mixing equipment, and by utilizing the recent advancements of modern gas generating equipment. Simultaneously, industry can look for much more versatile heating equipment.

With those outstanding technical improvements on the way, the industry can expect a successful year. The degree of success can be greatly enhanced if outmoded government depreciation policies are modified.

Heat Treating Facilities Offer Good Proving Ground

J. H. Ries—This year will witness an even greater diversification of operations in the commercial heat treater's plant. The facilities provide a perfect proving ground for a wide variety of applications.

Varieties of atmospheres and highly instrumented automatic equipment will permit quality production on a job lot basis.

Dimensional control and surface condition of the work in process continue to present the greatest challenges. Where these factors lie within the control of the heat treating process, the commercial heat treater, by combining the latest developments with ingenuity, will present to the metalworking manufacturer a service that is professionally unequaled.

Research and Equipment Seen Key to Progress

R. B. Hanna—We foresee excellent growth in the heat treating industry during the next few years. However, we feel strongly that the growth will be enjoyed only by companies that invest heavily in research and development to perfect equipment which will speed heat treating and improve quality. We believe that the new, high production furnace for bright annealing stainless steel strip; jet coolers; and the new, fluidized bed furnaces and quenches would not have materialized without a strong development program.

It seems apparent also that only companies that utilize the newest equipment and processes will grow and prosper. Example: Since introduction of the stainless steel strip furnace, stainless producers have ordered five furnaces. Here is a case where the users recognized the need for fast action to achieve a better product and the need to be competitive. In less than a year, the consumer will begin to enjoy the benefits of the better steel produced from these furnaces—a real tribute to the stainless industry.

V. R. TROGLIONE
President
Sunbeam Equipment Corp.
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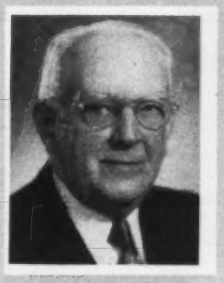

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C. I. Hayes Inc.
Cranston, R. I.

J. L. WHITTEN
Senior Vice President
Lee Wilson Engineering Co.
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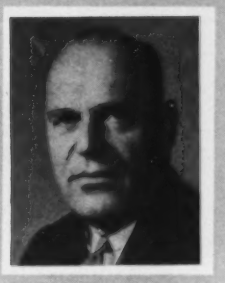


F. O. HESS
President
Selas Corp. of America
Dresher, Pa.

Infrared to Control Furnace Atmospheres

H. F. Coyle—We are eagerly anticipating major contributions and advances in the scientific knowledge of heat treating atmospheres.

That has been an area of intensive study by furnace manufacturers for years. However, exploration has been handicapped by the lack of adequate instrumentation to continuously measure and control the concentrations of gas compounds found in such atmospheres.

Introduction of a multiple infrared control system should provide a practical means for the effective control of atmosphere composition. It is engineered into equipment for application to metallurgical atmospheres.

Measuring and controlling one specific gas compound in a carbonaceous atmosphere is not the complete answer to the ultimate control of the surface chemistry of the parts being heat treated.

However, field experience has proved that excellent reproducibility is possible when control settings of the infrared equipment are correlated with the surface chemistry desired. The gas compound generally controlled is CO, CO_2 or CH_4.

More Integration of Heat Treating Equipment Expected

V. R. Troglione—We look for an accelerated trend toward integration of heat treating equipment into automated production lines. Manufacturers are becoming acutely aware that mechanized heat treatment can play a dominant role in the over-all cost of producing their products. Further, human variables must be minimized if progress is to be made in economy and efficiency in production.

Increased emphasis on the importance of automatic equipment has stepped up research and development programs throughout the furnace equipment industry. Appropriations for development are being increased. Also, the time between the conception of the idea and a marketable product has been reduced.

Recently, our company announced several new furnaces, results of a major furnace development program now in its second year. Other new products will be introduced this year.

Looks for Furnacemakers To Diversify Products

C. I. Hayes—Prospects for the furnace industry, as a whole, are not exactly the brightest—although electric furnace manufacturers seem to be faring better than makers of oil or gas fired types. As a countermeasure, most companies will be seeking to diversify their product lines to include such areas as electronics, chemicals, and instrumentation. We are allocating 7 to 8 per cent of our sales dollar to develop new products and new information related to the behavior of various materials under heat and under atmospheres.

Further development work in 1961 will involve perfecting the design and enlarging the scope of the cold wall vacuum furnace to make cold wall, controlled atmosphere furnaces and new breeds of semicold wall units. The semicold wall design will be a cross between the new cold wall concept and the old solid pack refractory construction.

We note a growing need for self-contained, continuous gas generators.

We should witness further progress in ultrahigh frequency heat—the "radar" approach—for nonmetallic materials. A silicon rectifier-transistor device for stepless control of such things as power and temperature to closer tolerances will replace other electrical components.

This will be the year of the engineering approach to technical problems.

Predicts Further Gains In Gas Alloying

J. L. Whitten—We expect further gains in the use of open coil type annealing and gas alloying in 1961.

Developments in proper atmospheres to react with the full surface of a coil exposed by the open coil process permit the addition or removal of carbon and nitrogen.

Areas of interest include the manufacture of single coat enameling iron by decarburizing to 0.003 or 0.004 carbon and the conversion of a rimmed steel to a nonaging variety, eliminating aluminum killing.

Active interest is shown by the fact that more than 1000 coils have been processed in the pilot installation.

New Approaches Vital In Heat Processing

F. O. Hess—It is absolutely inconceivable that past practices will suffice in the world competitive market and in the economic cold war. We face lower wages, a spirit and willingness to work, entirely new and modern production facilities, and a determination to progress—demonstrated by new developments, process and product improvements, and research conducted by well-qualified and able staffs.

There is already considerable importation of "knowhow" from abroad.

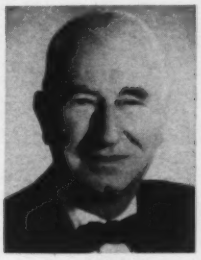
Fortunately for the heat treating field, U. S. equipment, designs, and experience so far are considerably advanced over practices elsewhere. That provides, for some time, a good opportunity for export of designs and equipment.

Our industrial technology must be willing to search and accept new approaches. Forging, to survive, will need to pay considerable more attention to factors in-

Heat Treating

H. M. HEYN
Vice President
Surface Combustion Div.
Toledo, Ohio
Midland Ross Corp.

W. H. HOLCROFT
President
Holcroft & Co.
Detroit



P. C. OSTERMAN
President
American Gas Furnace Co.
Elizabeth, N. J.

M. R. OGLE
Sales Manager
Drever Co.
Bethayres, Pa.

fluencing quality, such as scale, uniformity of heating from piece to piece, and time and temperature cycles.

Only progressive planning and thinking will offset the fact that nothing we did yesterday or are doing today will be good enough tomorrow.

FURNACES

Heat Treaters Want Speed and Quality

H. M. Heyn—Our research, development, and product improvement programs are directed toward these major areas:

1. Strip lines. Producers of ferrous and nonferrous metal strip are interested in ever faster and higher quality processing. The development of equipment for rapid and uniform heating is a major contribution. A single pass furnace for nonferrous metals has improved strip quality; the strip is never in contact with hot rolls which could mar it.

2. Automation. There is a continuing trend toward automation. Fully automated heat treat lines produce excellent results on highly specialized end products, where uniformity, speed, and cost reduction are major factors. The recent trend is toward highly mechanized, batch type operation which allows flexibility of type of heat treatment, as well as of sizes and shapes of parts.

3. Atmospheres. The search for better process equipment continues. In generally accepting heat treatment with gas atmospheres, industry demands better controls and simplified design of foolproof process equipment.

4. Heat transfer. Improved heat transfer resulted from the development of power convection furnaces, and the principle is also applied to fast cooling.

5. New materials. The missile and jet age has created a challenge to metallurgists for the treatment of new metals and alloys, with ever increasing requirements for higher quality metal treatments.

Competition Will Force Elimination of Frills

W. H. Holcroft—It would appear that we can expect a more competitive type of business during 1961. That should be good not only for the industrial heating equipment industry but for industry in general. General complacence has been shaken by foreign competition. It will be necessary for us to reconsider relative values. Quality will be in demand. Price with quality however will remain extremely important. Elimination of unwarranted frills both in management and equipment will be necessary.

Each inquiry should result in a challenge to engineering ingenity. Too often, inquiries result in attempts to adapt previously built equipment. Results of applied ingenuity have shown up in use of refractory ceramics for rails, bearings and shafts, improvements in sealing rolls in roller hearth furnaces, scrapping of takeups in conveyor furnaces, more effective high temperature head heating, new concepts in convection heating and mechanical and clutch type interlocks on mechanical drives. All of such improvements have resulted in lower prices to customers.

Multiple Unit Automation To Grow in Heat Treating

P. C. Osterman—Large production plants handling volumes of similar and identical parts will continue to require special, automated heat treating installations that are big. But trends toward product diversification have caused progressive manufacturers to reconsider the use of smaller, more adaptable, multiple automated furnace installations. (Four, 800 lb/hr automatic furnaces operate efficiently at varying levels of productivity and with more product diversification than one, 3200 lb/hr unit.)

Too often, automatic equipment—as one plant engineer put it—merely moves the workers from the production line into the maintenance department. Avoiding the problem requires re-examination of principles and adhering to simplicity in design. The part being heat treated must receive individual heating, exposure to atmosphere and quench. Rotating retort heating machines and rotary drum quenching tanks "keep the parts in motion" at all times during all phases of processing.

I believe that U. S. industry will assert its productive superiority over foreign industry by building into its facilities the ability to manufacture a profitable product mix at all levels of output, and heat treating departments will turn to multi-unit, automatic furnaces to achieve the result.

Vacuum, Atmospheres Areas for Furnace Progress

M. Robert Ogle—Probably no greater period of challenge has ever faced the metalworking industry in the U. S. It is confronted by a world-wide competitive situation.

The metalworking industry is going to meet the challenge and must at the minimum: Modernize facilities, develop new products, improve quality and service, effectively utilize invested capital, reduce the impact of high priced labor on the selling price, and use those factors to sell at home and abroad.

Automation is a word that has been abused by misuse. However, automation as a means of reducing labor costs re-

Heat Treating

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Milwaukee
Division of Basic Products Corp.

H. N. IPSEN
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F. T. COPE
Vice President
Electric Furnace Co.
Salem, Ohio

H. B. OSBORNE JR.
District Manager
Tocco Div., Ohio Crankshaft Co.
Cleveland

mains of paramount importance.

New product development will require furnace designs for higher temperatures, and expand the use of prepared atmospheres and vacuum.

The furnace designer will more and more have to consider the requirements of the total process to integrate furnaces with material handling facilities in the complete plant layout. Punch card control will continue to expand for control of mechanized heat treating operations.

HIGHER TEMPERATURES

Higher Temperatures Will Go Commercial

E. E. Staples—Metal melters will obtain great relief from the profit squeeze by utilizing a complete new range of induction melting furnaces. Low cost chips, turnings, or other scrap metals from aluminum to steel are melted without loss while producing higher quality castings. The 60 cycle, induction furnaces eliminate gassing and refine the melt by controlled electromagnetic stirring.

Tomorrow's equipment will continue the trend to higher temperatures with closer control, special atmospheres, and more automation. Demand is frequent for temperatures in the order of 5000° F, requiring graphite or tungsten resistors, instead of 3200° F with molybdenum. Argon, helium, nitrogen, or other special atmospheres (including vacuum), are often specified and control at ±5° F is wanted. In the 1500 to 2500° F range, temperature control within 1° F is frequently required.

While the above applies mainly to smaller furnaces used in the electronic industries and laboratories, buyers of larger furnaces also are asking for better atmosphere control with lower dew points and a greater degree of automation. High purity refractories and superalloys are necessary to meet the stringent specifications. New, more precise, special mechanisms are being developed for movement of parts through closely controlled temperatures in heating and cooling zones.

Higher Temperatures Lift Ceramic Material Uses

H. N. Ipsen—Continued stress on higher temperatures, both from materials application and related process requirements, will lead to rapid expansion of vacuum technology. Heat treating under a regulated vacuum is the ultimate "neutral" environment.

Automation of evacuation, heating, and cooling cycles reduces labor requirements, and the equipment is immediately ready for use. Secondary operations such as tempering can also be handled in vacuum to preserve the bright finish of the work. High production continuous units can be designed, and in the next year or two there will be general acceptance of the larger units.

Further development of ceramic and refractory materials for high temperature furnace components will improve furnace life expectancy. A lightweight, insulating firebrick for applications to 4200° F has been developed and ceramic materials have been used for fans, rolls, radiant tubes, and burners. An all-purpose atmosphere furnace to operate in a 1400 to 2500° F range will soon be a reality.

Extremes of Heat and Cold Pose Equipment Problems

F. T. Cope—New developments are of extreme importance because of the upsurge in foreign competition. Sales of heavy equipment abroad are taking up slack in domestic orders; the equipment will certainly come home to haunt us in the form of increased productivity overseas. It behooves us to increase our efficiency and ingenuity.

We can expect to see greater use of automation, with more and more heat treating equipment placed in a production line and treated as automatic machine tools. Perhaps they may even be tape controlled. Higher operating temperatures are continually requested, so increasing use will be made of refractory metals and superrefractories entailing rare gas atmospheres and vacuum.

New means for faster and more uniform heating and cooling are being sought—and will be found. Induction heating, both low and high frequency, will play an increasingly important role.

Although cryogenics is in its infancy, it is quite evident that cold will be an important factor in the treatment of certain alloys and that special heat treatment will be required to provide desired physicals at low operating temperatures.

INDUCTION EQUIPMENT

Restraining Fixtures Greatly Reduce Warpage

H. B. Osborne Jr.—It has long been known that a correctly designed and built induction heating fixture will heat and quench to give a product without distortion traceable to the heat treating. Prior stresses in parts accounted for dimensional instability, so subsequent straightening was often necessary.

To reduce costs in metal processing, the induction heat treating industry has extended its efforts beyond just heating

Heat Treating

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Ajax Magnethermic Corp.
Youngstown

H. M. ROWAN
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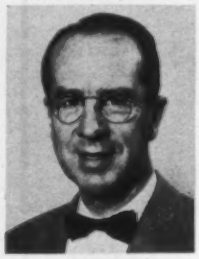
Inductotherm Corp.
Delanco, N. J.

A. F. HOLDEN
President
A. F. Holden Co.
Detroit



L. B. ROSSEAU
President
Ajax Electric Co.
Philadelphia

and quenching. Induction heat treating fixtures now have restraining and straightening devices that exert forces of location, direction, and magnitude so that even long spindly parts being continuously surface hardened are held to limits of but a few thousandths of an inch runout. In many instances, the part is well within finished tolerances. Where it has been impractical to hold parts to such accuracy, the amount of straightening has been greatly reduced.

The added cost of the so called "restraint" device is substantial, but the savings by reduction or elimination of straightening more than justifies it.

The induction heat treating machine with the "built-in straightener" will not only be used in the processing of parts, but it will be applied to the processing of materials as well. Look for such operations right back to the material source—the steel mills. They too must reduce their costs and provide stock to more acceptable tolerances.

Induction Is Making Inroads In Heavy Heating Applications

B. E. McArthur—Induction heating is moving in what might be considered two opposite directions.

One is the normal extension into the more difficult, more precise applications of tomorrow. The other might be called the lower technology—applications which have been considered to be adequately served by simpler forms of heating. Equipment that is rugged enough and large enough to become an accepted part of heavy industry production lines has been developed and proved in service. Examples: Units that heat steel billets 30 in. in diameter by 65 in. long; units with power inputs of 3000 to 5000 kw; and units that produce several hundred large billets per hour. They provide a sound basis for predicting higher tonnage, higher production, higher kw applications in the near future.

A similar situation: Induction heat is becoming an accepted and essential means of processing larger tonnages of metal because of the development and use of large, more rugged, longer lasting equipment. For example, U. S. production of galvanized sheet steel in 1960 was about the same as it was in 1956, but in the same period, production of induction heated galvanized sheets doubled. They account for nearly one-third of total output.

Similar patterns are evident in both the ferrous and nonferrous melting fields, indicating more and larger induction melting furnaces for the coming years.

Foundries Are Turning to Induction Equipment

H. M. Rowan—Only a few years ago, temperatures of 4000° F were largely laboratory applications. Now refractory metals, tantalum capacitors, and other connected applications are making such temperatures commonplace.

The wider use of corrosion resistant alloys and low carbon stainless steels is causing many captive and jobbing foundries to investigate induction.

The bronze industry is quickly recognizing the metal loss associated with some melting methods. A need to reduce the cost has brought about substantial induction activity.

Smog control in highly industrialized areas often requires huge expenditures to eliminate pollution. By channeling the expenditures into induction melting, many companies eliminate the need for further smog control measures.

Those factors, coupled with the development of simpler, more compact or integrated induction systems, are strongly offsetting the apparent dip in the economy.

SALT BATHS

Equipment Widens Use Of Molten Salt Baths

A. F. Holden—Progress in the use of salt baths is specifically related to the development of improved equipment. For example: Large, deep pots, 6 to 20 ft, or deeper. A new development provides for the removal of sludges and the replacement and support of electrodes.

Salt pumps and the better understanding of infrared thermal radiation can control heat transfer for descaling or cooling.

It is now proved that several types of steels may be formed at 1800 to 2200° F and quenched in hot salt. This eliminates extra handling of parts and makes use of the stored heat.

Sees Salt Bath Expansion Beyond Heat Treating

L. B. Rosseau—In the salt bath field, developments in trends underway rather than radical departures from established practices will be emphasized in 1961.

Equipment users are asking for "package jobs" when multistep processes are involved. Another important facet of a heat treating process is mechanization. New, lighter, more versatile, and yet more rugged mechanisms are being developed. However, we believe that for each application we should be sure that a process can be mechanized without being handicapped later by a change in material or specification.

We predict the use of salt bath heating equipment in fields other than heat treating. We believe that salt baths will be used much more than in the past in the glass, chemical, and metal melting fields.

TOUGH DIET FOR TIN PLATE

Canned fruit salads may be easy on fashion-trim figures but they're murder on containers. To withstand biting food acids, the tin plate must be securely bonded to the steel . . . a trick that calls for thorough cleaning of the steel before plating. One of the latest Pennsalt cleaners does the job in superior fashion. In fact, nine out of ten cans produced today get their start with Pennsalt tin mill cleaners.

The first job-engineered tin mill cleaners were pioneered by Pennsalt some 23 years ago. Pennsalt has maintained its leadership by keeping pace with changes in plating, rolling and annealing techniques . . . and today offers a complete line of cleaners to meet modern tin mill requirements. The same chemical ingenuity and application experience are key ingredients in the broad line of chemicals and equipment which Pennsalt supplies to the metalworking industry. Write or call us for a consultation on your own finishing problem.

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METAL PROCESSING DEPARTMENT

PENNSALT CHEMICALS CORPORATION

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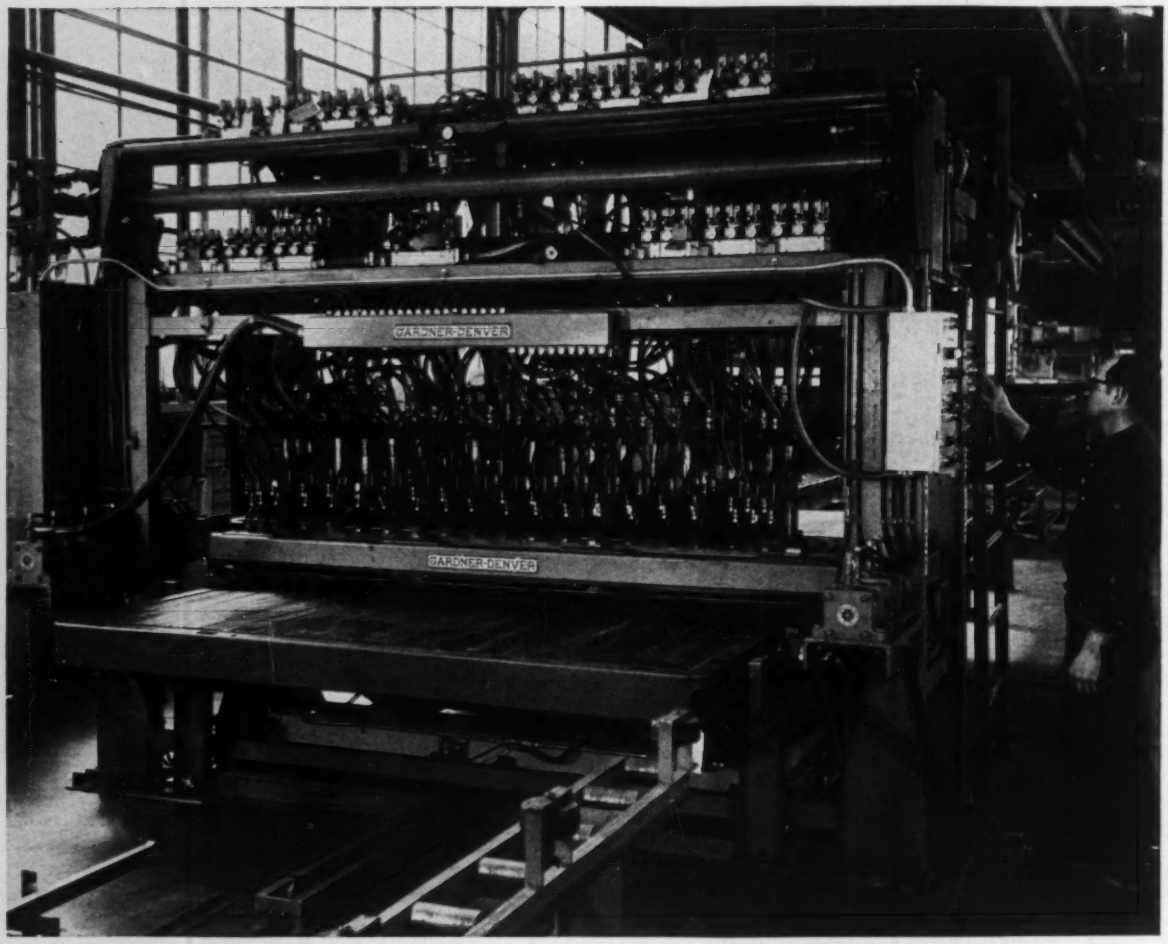
DRILL FEED DRIVE

with one automatic machine

Here's a push-button, air-powered machine specially designed and built by Gardner-Denver to drill holes, feed and drive screws automatically in a truck bed. Machine carries 20 Airfeedrills® and 20 screw drivers on a cross slide—enabling it to handle up to 40 holes in a row. Truck bed automatically positions itself for the next row of holes.

This is typical of how Gardner-Denver custom-designs production machines to automate any drilling or fastening job—saving time and money. For details, contact your Gardner-Denver air tool specialist or write for information.



Gardner-Denver production machine drills wood and metal truck body—sets ¼" x 2¼" self-tapping screws automatically at rate of 4560 per hour.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

ROBERT B. OLIVER
President
Society for Nondestructive Testing
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LOUIS A. WELT
President
Steel City Testing Machines Inc.
Detroit

WARREN J. McGONNAGLE
Group Leader, Nondestructive Testing
Argonne National Laboratory
Argonne, Ill.

JOHN C. SMACK
Nondestructive Testing Consultant
Princeton Div.
Curtiss-Wright Corp.
Princeton, N. J.

TECHNICAL PROGRESS

Inspection and Testing

Experts foresee: Extension of eddy current process, neutron analyzers, more automatic testing devices, faster x-ray inspection

Society to Continue Services To Improve Reliability

Robert B. Oliver—The handbook issued by the Society for Nondestructive Testing fills a real need for a concise presentation of fundamental principles and methodology. As a continuing aid, the society will continue such service.

The council and its committees are working on testing problems of broad industrial import. Significant contribution is the wedding of sound technical knowledge to problems of material and design development, of process control, and to quality control and reliability.

Today's complex, expensive products are possible, largely because of sound applications of proved nondestructive testing methods.

Testing Before Fabrication Ups Productive Efficiency

Louis A. Welt—Increasing competition among metalworking concerns, coupled with a continuing rise in material and labor costs, makes improved productive efficiency imperative. Nondestructive testing methods offer several ways of accomplishing that end. By showing how the metals will react during fabrication, such tests permit selection of the best materials, the most suitable methods, and the elimination or reduction of scrap.

We see a continuing trend to more tests directly on the production line for stricter quality control. Consistently scheduled testing before and during processing is much more effective than sporadic testing after production—the causes can be corrected before scrap is made. Such requirements call for the development of more rugged, increasingly automated, less expensive testing machines.

Tubing Quality Challenges Nondestructive Testing

Warren J. McGonnagle—Metal tubing is employed in some nuclear reactors, is being considered for others. Some of the metals and their alloys have desirable nuclear properties. In addition, they are corrosion resistant and have good thermal characteristics.

The quality of such tubing must exceed that required in ordinary industrial applications.

We see a real opportunity for people in nondestructive materials evaluation to perform a much needed and worthwhile service in that area. It will be necessary for them to evaluate the fabrication process as well as finished material. Such evaluations should be made before and after reactor irradiation.

It is feasible to improve the quality of tubing without greatly increasing the cost of the finished product. That can be done by proper application of recent developments.

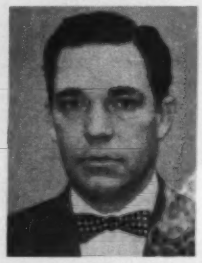
More Nondestructive Units Needed for Automation

John C. Smack—We see increasing demand for higher quality.

Automation especially requires close nondestructive testing controls. Many

Inspection and Testing

E. ALFRED BURRILL
Vice President & Sales Manager
High Voltage Engineering Corp.
Burlington, Mass.



JOHN P. BATTEMA
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Nondestructive Test Instrumentation
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WILLIAM D. KIEHLE
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WALTER S. BAIRD
Chairman
Baird-Atomic Inc.
Cambridge, Mass.

producers of steel, beryllium, molybdenum, tungsten, copper, zirconium, and fabricated combinations are following the lead of the aluminum and aircraft industries. They are adopting immersed, ultrasonic testing techniques which lend themselves to automatic or semiautomatic testing with recording.

Nondestructive testing has recently tripled bringing a shortage of operators, inspectors, and supervisors. We also see a pressing need for a more widespread knowledge of testing fundamentals.

Here are some examples:

1. Testing the welds in large steel pipe.
2. High speed testing of railroad axles.
3. Testing of ¼ in. tubing to locate defects 0.003 in. deep.
4. Automatic recording of honeycomb aircraft panel bonds and defect location in critical nuclear fuel elements.

In addition, continuous, automatic betagages can measure 0.0004 in. tantalum foil and polyethylene films 0.0005 in. thick.

X-RAY

Linear Accelerator to Get Heavier Industrial Role

E. Alfred Burrill—Industry will turn more and more to particle accelerators for research, engineering, and production. Supervoltage, x-ray generators for radiography have become increasingly common ever since World War II.

The microwave, electron linear accelerator (Linac) is being pressed into industrial service for the production radiography of heavy steel sections up to 2 ft thick. Its penetrating power, great intensity, and good radiographic qualities make it possible to inspect high pressure vessels and bulky castings with a speed never before achieved.

Neutrons from particle accelerators will become useful for the analysis of trace components, as well as for continuous monitoring of chemical composition in a production line. Apparatus development is sufficiently advanced to incorporate the method directly into production.

Research laboratories are learning much from bombardment by high energy positive ions and neutrons. It is becoming possible to consider the incorporation of particle accelerators directly into the industrial laboratory for studies in metallurgy, solid state, surface analysis, and production methods.

X-ray Progress to Include Better Pictures, Definition

John P. Battema—The nondestructive testing technology of penetrating radiation is advancing rapidly. Lighter, higher powered, portable x-ray units are being developed which will greatly increase applications in field erection and pipeline construction. Portable examples now available operate at 200,000 volts, 5 milliamperes, and will penetrate 2 in. of steel. Such tubeheads weigh only 88 lb and can operate continuously.

Further refinements in the technology include: Clearer, brighter pictures; in-motion radiography of long welds and large panels with exceptionally high definition.

Much evaluation is being carried on in neutron radiography. Linear accelerators equipped with special targets to supply neutrons can radiograph exceptionally heavy sections of some materials with only short exposure times.

Also coming: New types of pulse generators for flash radiography; high speed, motion picture fluoroscopy to study small moving components.

Nondestructive Testing Is Now a Profession

William D. Kiehle—Automation of the film processing cycle will be a prime factor in the growth of industrial radiography during 1961. The fact that new processors can handle large quantities of sheet film and long rolls of strip film up to 17 in. wide is vital to industry. Moreover, the capacity of such equipment to deliver fully processed radiographs in 13 minutes is most important to aircraft construction industries and airline maintenance bases. That feature alone should contribute to the reduction of maintenance inspection time and costs.

Another innovation: Individually wrapped sheets and strips of x-ray film in "ready pack" form. They will provide many advantages to an industrial radiographer in the inspection of parts which do not require the use of lead screens.

Another factor of coming importance: The high voltage particle accelerator. Units such as the supervoltage linear accelerator with its high energy output and the neutron generator with its unusual absorption characteristics will be most important to the inspection of missile motors and nuclear components.

The need for specialized college training of nondestructive testing engineers is becoming more apparent. This form of inspection is no longer a mere group of techniques; it is a profession, an integral part of the production of aircraft, missiles, ships, pipelines, and boilers.

Foreign Steelmakers Buy U. S. Testing Equipment

Walter S. Baird — We have noted a considerable increase in sales of spectrographic equipment, research spectographs,

Inspection and Testing

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Norristown, Pa.

J. C. REIDER
Manager, Metals & Mining Div.
Industrial Nucleonics Corp.
Columbus, Ohio

V. E. LYSAGHT
General Sales Manager
Wilson Mechanical Instruments Div.
American Chain & Cable Co. Inc.
New York

HAMILTON MIGEL
Vice President, Research & Engineering
Magnaflux Corp., a subsidiary of
General Mills
Chicago

direct readers (spectrographs), and Spectromets in the U. S., Europe, and Japan—the most significant increases are in Japan.

In talking with our foreign customers, it has become obvious that all the arguments which U. S. customers have used are of concern to them too. They want savings, which include the elimination of offanalysis heats; shorter furnace holding time (more heats per month, minimum loss of alloying elements, longer furnace life, lower fuel costs); conservation of expensive alloying elements by aiming at the low side of the specification; detection of harmful tramp elements; and reductions in manpower, supply, and space needs for testing.

While many direct readers are for analyses of basic metals, we notice a growing tendency by foreign customers to analyze for elements. That leads us to believe they are moving in the direction of the more specialized steels and that foreign competition in steel is really just beginning.

Nuclear Gaging Will Gain In Basic Mill Applications

A. J. Stevens—Applications of radiography in metalworking will continue to grow at a rate of about 25 per cent a year. It seems unlikely that any drastic changes will occur in either equipment or applications. The trend toward stronger sources should continue.

Nuclear gages have been slow and restricted to relatively thin metal. New gages overcome both limitations.

Gaging equipment will now respond in 0.01 second. Steel up to 12 in. thick can be gaged with a tolerance of less than 0.1 per cent. High temperature presents little difficulty. As a result, we look for nuclear gages to come into extensive use in hot strip mills, pipelines, and structural mills.

New nuclear gages are also adaptable to flaw detection in thick sections. Example: The pipe termination in hot blooms for cropping. Similarly, in the nonferrous industry they may be used for flaw inspection in aluminum ingots and in cast brass and bronze cakes.

The coming year will see the first installations of such equipment.

Isotope Gages to Bring Tighter Strip Tolerances

J. C. Reider—The development of production line, noncontacting isotope gages will expand the market for galvanized strip and help producers realize substantial raw material savings.

Auto industry demand for close tolerance, zinc coated strip may increase manifoldly in the near future.

The tight tolerances needed for automotive applications require the producer to use a faster, more representative measurement than present stripping methods.

Noncontacting isotope gages are expected to permit savings in zinc of up to 8 per cent.

Technological Advances Lift Testing Requirements

V. E. Lysaght—Technical progress is increasing demands for improved hardness testing procedures. The trend toward production control of surface hardness via the microhardness test will continue this year. Portable equipment capable of testing large tubes for missiles will be used to some extent. And hot hardness testing is receiving attention in connection with space metals.

Automatic hardness testing equipment is being investigated, but it has not been adopted yet. Reasons: The popularity of statistical methods and the rapid growth of semiautomatic testers with improved features. Also, the industry recognizes that the operation of Rockwell testers at more than 1000 tests per hour introduces errors.

We should see continued demands for greater accuracy and better maintenance this year. Standards are receiving greater consideration as hardness specifications become more closely defined.

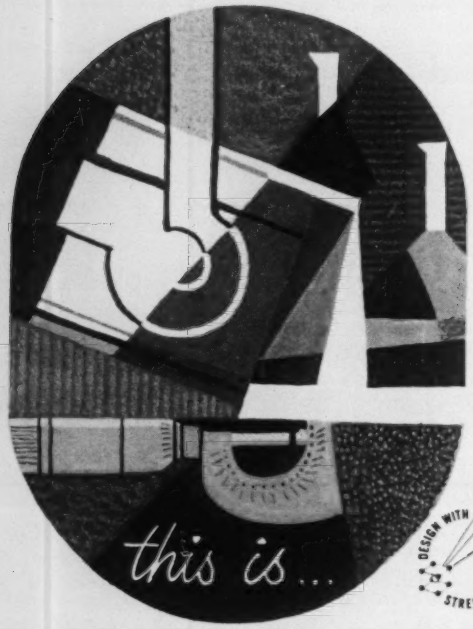
GAGING, TESTING

New Test Instruments Measure Tensile Strength

Hamilton Migel—Missile and space programs have necessitated the development of new, nondestructive, testing techniques for many components. For example, magnetic, particle inspection techniques have been developed and equipment has been built to test steel missile chambers. Such components have a safety factor approaching zero. Minute discontinuities, particularly surface cracks, must be reliably detected and eliminated. Because of the size and shape of the parts, magnetizing by the usual methods is not satisfactory.

Special magnetizing fixtures, making use of induced current, have been developed which provide a magnetic field of sufficient strength. Used with fluorescent magnetic particles, clear indications of even the smallest cracks are provided. Such equipment is in two principal missile plants and is planned for others.

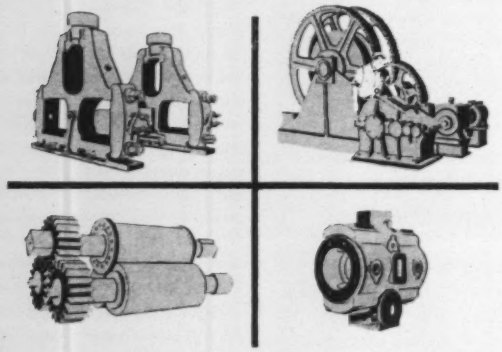
Another significant development for



SERVICE FOUNDRY

Chances are that you have us in mind as specialists in marine components and sugar machinery. It's a fact that our reputation was built on serving these fields, and we continue to do a large volume in them. What we would like to tell you is that we've expanded our facilities over the years to the point of extreme capability in electric furnace steel castings of medium and high carbon content, semi-steels in our iron foundry, and aluminum, monel and the various alloys of brass and bronze in our non-ferrous foundry. Our machine shop is equipped with some of the largest and most diversified tools in the South—rounding out our complete foundry facilities.

Service Foundry would like to work for you. Your inquiry will bring a prompt, definite reply.



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a division of AVONDALE SHIPYARDS, INC.

Inspection Testing

H. F. OSTERMAN
Sales Manager
Branson Ultrasonic Corp.
Stamford, Conn.

spacecraft: An eddy current instrument for an instantaneous check on the mechanical properties of steels such as aged Armco 17-7 PH. Hardness determinations do not indicate ultimate strength. A simple, probe type instrument gives an instantaneous reading at any point without electrical contact. It can be applied while the sheet is being stretched, and is therefore used to control the process. A careful check with physical test specimens has shown that the eddy current instrument is accurately indicating yield and ultimate strength.

Ultrasonic Testing, Gaging Gaining in Steel Industry

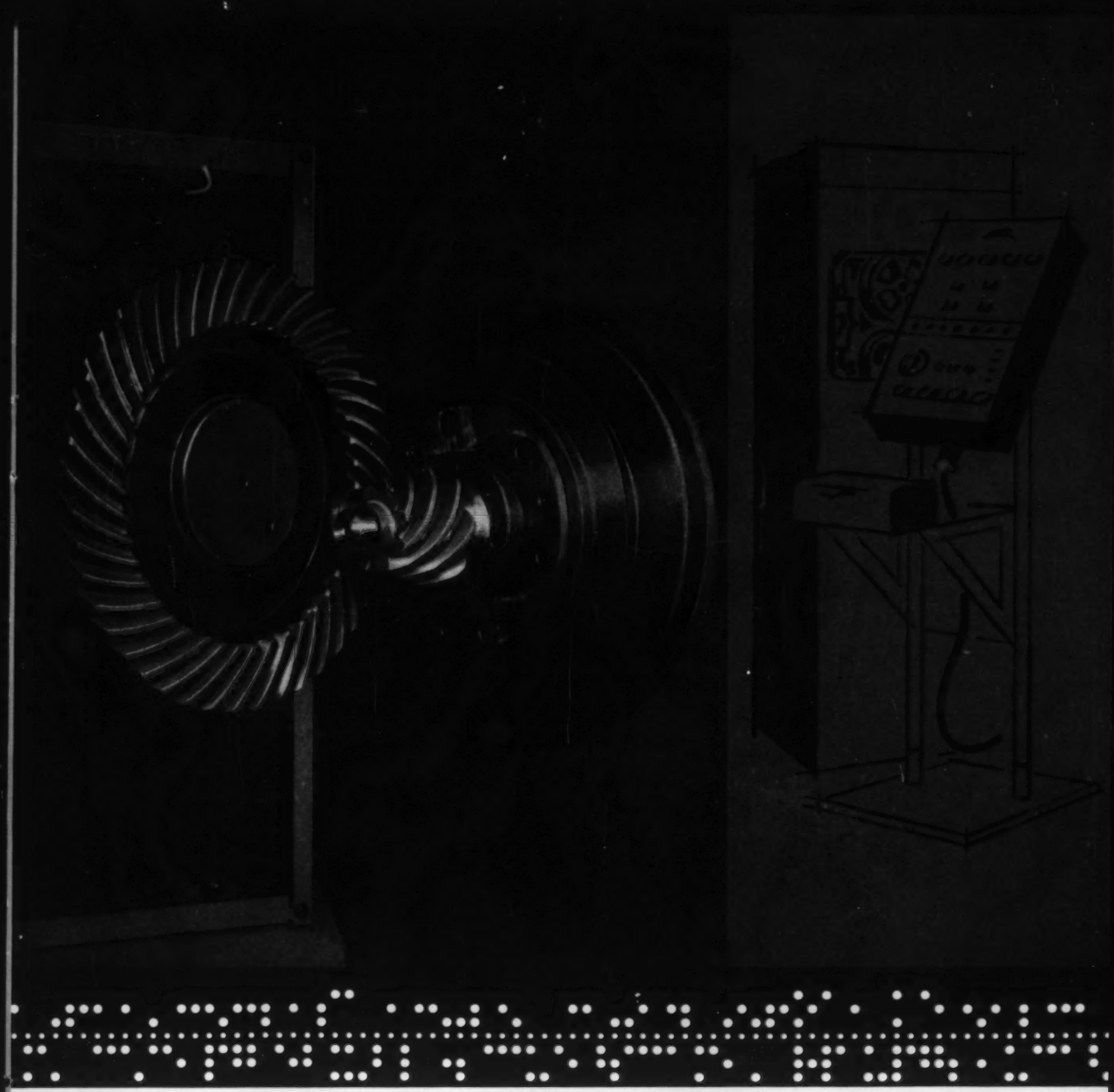
H. F. Osterman—Ultrasonic testing and gaging will continue to gain because of increased competition.

Instrumentations will be improved to permit fuller utilization of the information detected by ultrasonic waves passing through the part being tested. That includes such studies as ultrasonic attenuation, velocity measurements, and acousto-elasticity.

A general trend in the industry toward in-process testing and gaging requires increased use of automatic or mechanized scanning equipment and electronic monitors or recording devices. Some newer scanning techniques: Use of the semi-contained liquid column and a liquid filled wheel search unit.

Liquid column or immersion scanning has been adapted to ultrasonic resonance gaging, permitting high speed scanning and detection of extremely small thickness variations. The technique also improves the reliability of measurements on materials 0.004 to 1 in. thick.

Needed: Increased ingenuity in exploiting the capabilities of present and future equipment, and in using the information ultrasonic tests can obtain.



Gleason Works announces automatic gear tester operation through tape control

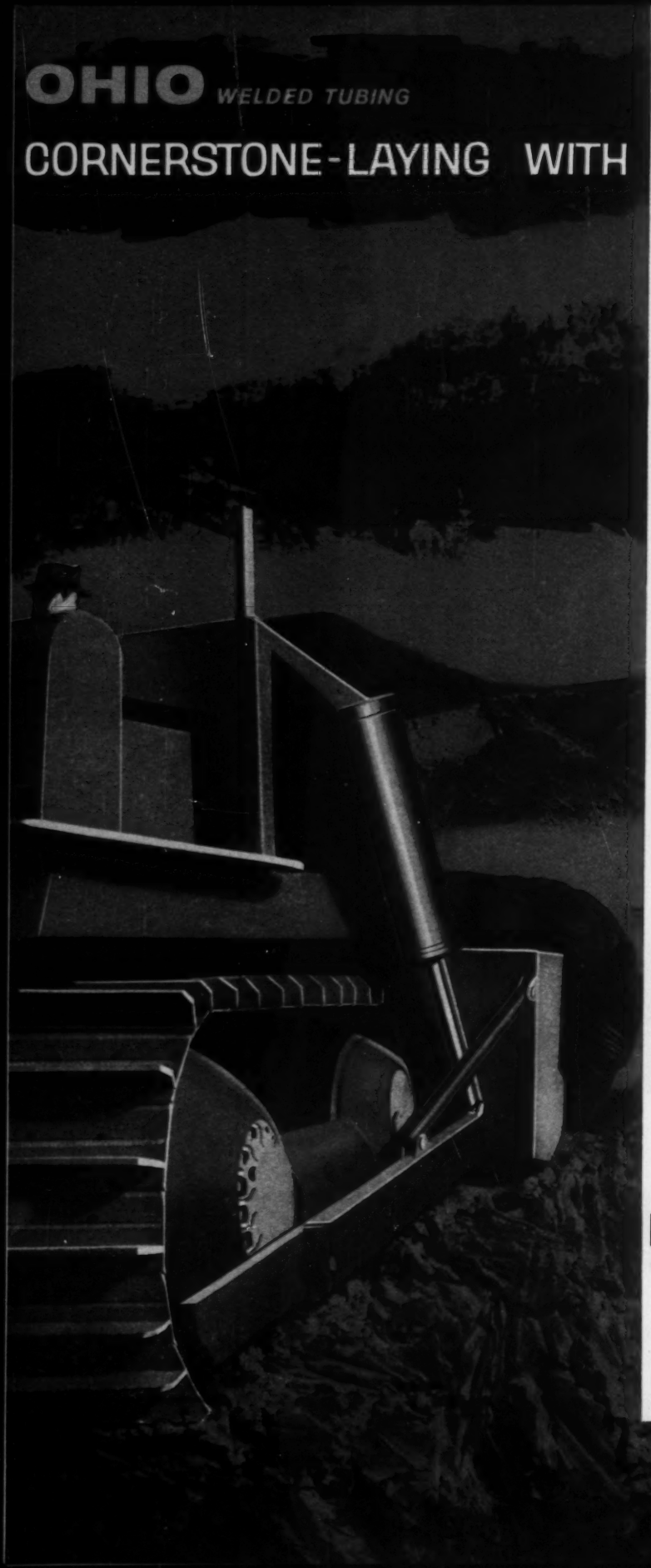
Electronic tape control on Gleason Production Testers will make your bevel and hypoid gear tester operation an automatic process. Tape controls will allow you to automatically pre-set and vary test factors—direction of rotation, tooth bearing position, pinion spindle speed and brake load—in any sequence you wish.

Once you tape the test sequence, you can repeat it exactly anytime—for the next pair of gears or repeat the set-up months later.

Write us. We will be pleased to send additional information.

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.



OHIO WELDED TUBING

CORNERSTONE-LAYING WITH

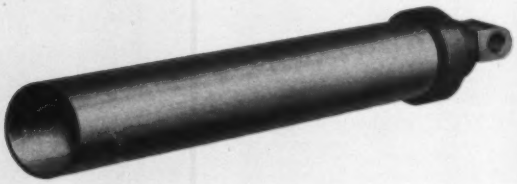
NO CEREMONY

In today's hustling, bustling construction business there's no time to stand on ceremony . . . no point in risking costly equipment failure.

To short-circuit mechanical downtime, leading construction equipment producers specify Ohio Tubing for power cylinders and fluid lines, mechanical and structural members. This gives equipment the heft and brawn to shrug off brutal, grinding punishment . . . gives equipment users a high degree of protection against disastrous delays.

You can strengthen your product — and its mechanical reputation — by specifying Ohio *Custom Made* Tubing. The name Ohio is the hallmark of the highest quality in tubing, both seamless and welded. And we're now able to deliver a broader range of welded tubing sizes, wall thicknesses and grades than ever before.

Let's not stand on ceremony. We want your tubing business — seamless to 7" OD, *welded up to 7½" OD.* For a fast start, contact your nearest Ohio representative, or send part drawings to the plant at *Shelby, Ohio—Birthplace of the Seamless Steel Tube Industry In America.*



Ohio Seamless offers the broadest parallel range of both welded and seamless quality steel tubing in the industry.

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A-3305A

JOHN C. SEARS
Executive Director, American Gear Manufacturers Assn., Washington

JOHN K. HUBBARD
Manager, Power Products & Advanced Systems Dept., Turbo Products Div., Clark Bros. Co., Div. of Dresser Operations Inc. Olean, N. Y.

ALTON S. CARTWRIGHT
Manager-Marketing, Direct Current Motor & Generator Dept. General Electric Co., Schenectady, N. Y.

J. ALLAN MacLEAN
President, Dodge Mfg. Corp. Mishawaka, Ind.

TECHNICAL PROGRESS

Drives and Controls

Digital controls, modular switches, and fluid power are being emphasized. Greater variety of drives is available

New Gear Classification Manual Available in Mid-1961

John C. Sears—By mid-1961, the gear buying public will have our new Gear Classification Manual. It provides for 16 classes of quality from the roughest cast tooth gear to the finest ground, shaved, or microfinished gear. Gears are covered in the ½ to 120 dp range of spur, helical, and herringbone types.

We can expect to have a companion inspection standard ready by the end of 1961. That will obsolete present inspection standards (231.02 and 236.04). The new work will enable the user and manufacturer to agree on the quality class by spelling out exact inspection procedures in each case.

Gas Turbine to Be Tried in Converting Atomic Energy

John K. Hubbard—The evolution of nuclear power has created an exciting gas turbine application. The conversion of atomic energy within the fuel core of a reactor to electrical power is ideally suited to the closed cycle, gas turbine. One such prototype plant is being built by Aerojet-General, funded jointly by the U. S. Army and the Atomic Energy Commission. The closed cycle, gas turbine drives a generator producing 400 kw electric power from an atomic reactor heat source. The whole plant is air transportable in two cargo aircraft and can run continuously for a year without refueling.

The future for gas turbines in conventional applications is assured with its present low cost and low maintenance. Though fuel consumption is relatively high, advances in metallurgy permitting higher temperatures will ultimately make it equal to that of other prime movers.

Drive Improvements Required For Process Automation

Alton S. Cartwright—Drive improvements are necessary for the trend toward automation and integration of computer control with production equipment. Such modernization recently permitted a 25 per cent increase in speed and a 40 per cent greater output per man in one rolling mill. A notable trend is the use of dc motors at points closer to the work, with reduction in intervening gearing and lineshafting. That is done to reduce time constants and speed reversals.

Examples are in the growing number of mill tables with individually powered rolls. To meet needs for higher reversing speeds, dc electric motors are applied directly to rolls to eliminate increases in the gearing costs, unplanned shutdowns, and lineshaft maintenance.

Other instances are the construction of machine tools with dc motors to provide adjustable speeds for spindles.

Drives Get Smaller; Ratings Up, Installation Is Easier

J. Allan MacLean—To help create more efficient plant equipment, manufacturers of mechanical power transmission prod-

Drives and Controls

G. E. SEAVOY
Vice President, Whiting Corp.
Harvey, Ill.

T. H. BLOODWORTH
Chief Systems Engineer, Industrial Systems Dept., Industrial Equipment Div., Allis-Chalmers Mfg. Co.
Milwaukee

RALPH FROEHLICH
Market Manager, Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.

W. G. PRASSE
President, Oilgear Co.
Milwaukee

ucts have invested heavily in engineering research. It's paying off with the development of new and improved industrial bearings, shaft couplings, speed reduction units, V-belt sheaves and belts, chain and sprockets, and power drives that combine compact, functional design with ease of installation, reduced maintenance, and longer service life.

The trend will continue in 1961 as new and better materials help extend the horsepower capacities of transmission components and reduce space requirements wherever possible.

Increasing interest is shown in devices like the dry fluid drive and rubber tire-type couplings, which can save power, prolong the life of expensive plant equipment, and reduce costly downtime for maintenance.

New couplings are being developed for direct mounting to the flywheels of internal combustion engines. The coupling will permit machinemakers to redesign and streamline their products to reduce space, weight, and costs. Also new are high speed couplings with greater torque capacities than flexible cushion couplings previously available.

CONTROLS

Hydraulic Controls Stressed In Metalworking Equipment

G. E. Seavoy—The use of hydraulics is increasing in metalworking, metal melting, and material handling machines and equipment. Examples: Hydraulic controls to operate the movement of electrodes in electric arc melting furnaces (good control represents more efficient use of energy) and hydraulic cranes (all mechanical movements can be accomplished with infinitely variable control and improved maintenance expense).

Most manufacturers are aware of the effect of foreign competition, yet they can be expected to seriously look at foreign machines, equipment, and processes when new projects of a capital nature are considered. It points to the increasing need for U. S. technicians to develop even better means and methods.

Mills, Auxiliary Equipment To Be Computer Controlled

T. H. Bloodworth—Demand for higher quality and keen competition has increased the emphasis on employing improved sensing devices, and on more automatic equipment to reduce human error.

In hot rolling, usage of card or memory programing to control width and gage will be increased. Many new mills will be designed with complete computer control. It won't be limited to the mill proper, but will also take in peripheral equipment (scales, tables, guides, shears, and scarfers).

Automatic gage control will also be used more in cold rolling. Developmental effort will be directed toward adaptive type control and high speed corrective devices to permit higher rolling speeds while improving over-all product quality. Many of the coil handling functions, as well as threading strip through the mill, will be automated.

Machine Tools Use More Grouped, Plug-In Switches

Ralph Froehlich—Future control devices on machine tools will employ more plug-in units, such as the plug-in limit switch. New, costly, complex machinery performs multiple functions. Downtime costs are high. Plug-in limit switches reduce downtime when switches must be replaced.

There is a trend toward use of basic type switches grouped into a single enclosure. Plug-in construction may be employed for the assembly. The enclosure could be used to provide multiple switching functions. The mechanical movements from the machine are brought to one area, and switching (as far as practical) is brought to the area to reduce difficulty in troubleshooting and to protect the devices from such things as coolants and chips.

I visualize mechanical switches being used for a great many years in machine control and look to the day when an environment-proof device might be built with a life 10 or 20 times greater than that of the present mechanical limit switch.

There is promise for static controls, but this will depend on reducing the cost of static controls and increasing the versatility to a point where they are competitive with the mechanical switches.

Fluid Power Use Expanded by Electrohydraulic Controls

W. G. Prasse—Electrohydraulic, servo-valve controlled, two way, variable displacement pumps (especially above 3 hp) have a tremendous potential in closed loop machine control where good stability, high system accuracy, and controlled speed of response are essential. The ability to remotely select (from switches on machines or at control stations) a great number of pump flows to satisfy complicated work cycles has opened a broader use for electrohydraulic, servo-valve controlled, two way, vari-

Variable-displacement pressure compensated

For top pump performance on every job!

Only Vickers offers you a complete line of hydraulic pumps tailored to suit your performance, life and price requirements.

* You can select from more than 500 standard models —vane and piston, fixed and variable displacement.
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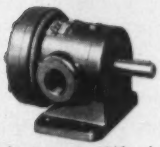
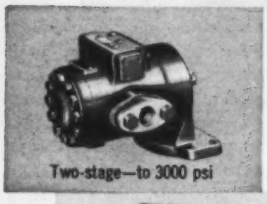
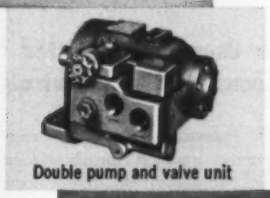
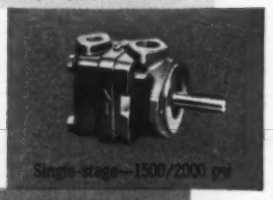
* Your replacement units and parts are stocked in regional warehouses . . . unequaled field and shop repair service is provided by factory-trained, experienced technicians.
* You are assured of simplified service and reduced inventory requirements with Vickers replaceable cartridge and repair kits.

For more complete information, write for 70-page Catalog 5001C.

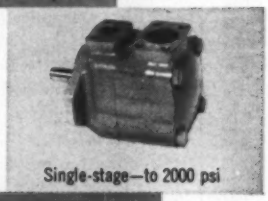

Single stage—to 1000 psi


Two-stage—to 3000 psi


Double pump and valve unit


Single-stage—1500/2000 psi

Double—1500/2000 psi


Single-stage—to 2000 psi

Double—to 2000 psi

Fixed displacement piston to 5000 psi

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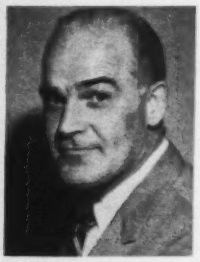
Drives and Controls

E. H. BROWNING
Manager, Metal Working Section
Industrial Engineering Dept.
Westinghouse Electric Corp.
Pittsburgh



D. E. DAVIDSON
Vice President Sales
Link-Belt Co.
Chicago

able displacement pumps in open loop systems.

New, single stage, servo valves, for flows from 100 to 6300 cipm, applied direct to hydraulic motors and cylinders are meeting demands for faster response and higher accuracy. New, two stage, servo valves for 23,000 to 185,000 cipm are providing precise remote controls for large presses.

Larger, two way, variable displacement pumps (above 200 hp) and equivalent sizes of reversible constant displacement motors are opening new applications.

Compact hydraulic tachometer units and small electrical feedback transducers provide flexibility in measuring machine response and complete the control loop for accurate speed and position control.

New Uses Are Predicted for Automatic Digital Controls

E. H. Browning—Significant recent developments include the introduction of highly transistorized digital automatic controls, such as card programing controllers, data accumulation systems, and on-line computers. Such applications will continue to grow, and the controls will be extended into new areas.

Digital data accumulation and logging systems for both rolling mills and processing lines will be on the increase. Data accumulation and logging systems provide management closer on-the-spot control of processes.

The growth of on-line digital computers for industrial processes in steel and nonferrous metals plants is just beginning. The computer calculates the best mill or processing line operating procedures and set points. It initiates and monitors intelligence to and from the electrical control systems associated with the various process zones, so that computed optimum conditions are achieved.

In time, on-line computers will be used for all metal plant operations, including metalmaking, metal rolling, and metal finishing. A trend to the more centralized, multiple process controlling computer will be evident.

TRANSMISSION

Greater Variety Available In High Quality Drives

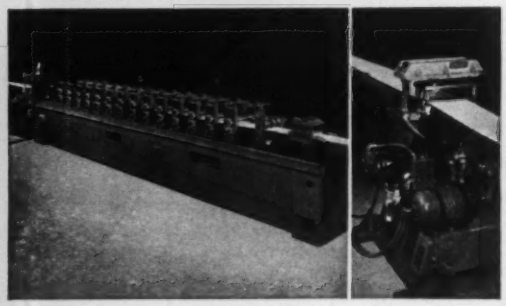
D. E. Davidson—The types and forms of transmission equipment have been limited. To meet demands for a greater variety, more types, sizes, and designs have been made available.

New quality standards make previous

AMERICAN ROLLER DIE CORP
ARDCOR

PRODUCTION EQUIPMENT
produces MILLIONS of SQUARES of

ALUMINUM SIDING



ARDCOR typical production line includes Coil Reel, Prenotch Press, Leveller and Roll Forming Machine—with Rotary Punching Unit for piercing nail and weep holes or slots, Cut-off Press and Runout Table.

Ardcor invites your inquiries for complete cold rolled forming lines—from coil to finished product—for all shapes. Many Ardcor high production lines are in use today—some manufacturers using over 15 complete lines.

What are your requirements? Write, or phone us, today!

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DESIGNERS, ENGINEERS AND BUILDERS: Single Roll Forming Machines or Completely Automated Production Lines for Cold Forming; Ferrous and Non-Ferrous Electric Weld and Lock Seam Tube Mills • Forming Rolls, Tubing and Pipe Rolls • Straightening, Pinch and Leveller Rolls • Cut-Off Machines • Slitters

Drives and Controls

JOHN V. MOYNES
Vice President & General Sales Manager, Morse Chain Co.
A Borg-Warner Industry
Ithaca, N. Y.

standards obsolete. Transmission performance that was once the best is now unacceptable. Improved performance is being attained via higher quality levels through quality control.

Variable speed drives with metal chains are offering precise control and greater horsepower ratings.

Speed reducers of the wormgear type are now offered with fan cooling for compactness; shaft mounted gear reducers offer versatility and adaption of mounting; gear motors and shaft mounted motor gear drives are expanded to larger horsepower ratings; and parallel shaft speed reducers have heat treated gearing for greater load carrying capacity.

New Horsepower Ratings Expand Roller Chain Applications

John V. Moynes—New advanced ratings for roller chain have been published by the Association of Roller & Silent Chain Manufacturers.

Not only do the ratings expand the application possibilities for roller chain, but you can now use smaller chains to do the same amount of work as previously and reduce transmission costs.

An important area where sophisticated techniques will be developed is in finite life design. Why should an original equipment manufacturer buy components whose life far exceeds the productive life of the equipment? Where total hours' life of the machinery is extremely low, where obsolescence will render the equipment useless, or where other components have limited life, the manufacturer of power transmission equipment will be able to specify products which will meet this demand.

STEEL WAREHOUSE "TAKES TO THE AIR"

Fig. 1 — TRAK-RAK fork lift at top of column, lifting bundle of steel rod. Unit serves 3 long aisles of racks.

TRAK-RAK SYSTEM INCREASES STORAGE SPACE, SAVES 22% CAPITAL BUILDING INVESTMENT

When A. C. Leslie & Co. Limited, needed more storage area in its busy Toronto steel warehouse, it decided to "reach for the ceiling" with a Chicago Tramrail TRAK-RAK System of vertical storage and handling. As a result, the company estimates it not only saved 22% of projected capital building costs, but increased the overall efficiency and speed of the Toronto operation. The company expects to gain further economies as the TRAK-RAK system is used to its full extent.

A 5 ton capacity toprunning TRAK-RAK Crane was installed in each of two 40 ft. wide bays to serve specially designed 18 ft. high material storage racks (Fig. 1). Each crane bridge has an overhead trolley, from which is suspended an electrically operated rotating column

Fig. 2 — Carriage equipped with 2 pairs of forks. Operator is flopping outer forks up.

equipped with a special fork lift. All operations of the fork lift, which revolves to serve either side of the aisles, moves toward or away from the racks, and raises or lowers on the column, are controlled by the operator who rides with the carriage.

Two pairs of forks are mounted on the carriage. The outer forks may be flopped back (Fig. 2) leaving the inside forks in position for handling palletized or crated material. For handling long boxes, bars, etc., the outside forks are flipped back into working position.

A TRAK-RAK feature which added to handling speed and insured safe operation was the safety interlock switch system which prevents the column from running

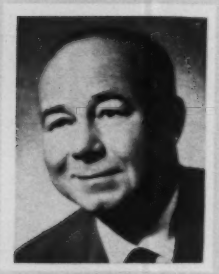
Fig. 3 — TRAK-RAK column requires minimum aisle space for operation.

into a rack and permits full rotation only when the unit is safely beyond the end of the racks.

The A. C. Leslie Company reports that a similar TRAK-RAK System installed in its Montreal warehouse permitted a 37% savings in capital building investment with equally good operating efficiency and economy.

For complete details on the TRAK-RAK System of vertical storage and handling, write the manufacturer:

CHICAGO TRAMRAIL CORPORATION
13265 Kostner Avenue • Chicago 23, Ill.



DON S. CONNOR
President
Micromatic Hone Corp.
Detroit

DONALD E. HAWKINSON
V.P., Machine Tool Sales
Greenlee Bros. & Co.
Rockford, Ill.

EVERETT M. HICKS
V.P. & General Manager
Machine Tool Div., Norton Co.
Worcester, Mass.

JAMES H. FLANDERS
Manager, Research & Development
Jones & Lamson Machine Co.
Springfield, Vt.

TECHNICAL PROGRESS

Machining

You'll find renewed emphasis on improved standard machines and more play on precision. Also look for an uptrend in tape control

Precision Creates Need for Sophisticated Machines

Don S. Connor—In our search for greater precision, we have seen allowable tolerances cut from thousandths, to tenths of thousandths, to millionths of an inch.

The true meaning and significance of tolerances in millionths of an inch should be understood before it is made part of a specification. In many cases, it will mean the use of new materials that are capable of holding their shapes after they are machined. New techniques and standards of design must be developed, and new methods of processing and handling must be perfected.

A machine tool designed to hold tolerances of thousandths cannot be expected to hold millionths in its old age.

Product Designers Hold Keys to Production Costs

Donald E. Hawkinson—The one most important area for achieving substantial savings in manufacturing costs is that of increasing co-operation at the design stage.

Designers' problems are intensified by the necessity for automatic handling and positioning through a series of machining operations. The increased popularity of aluminum, magnesium, and zinc permanent mold and diecastings has brought further complications. More and more, product designers discuss their problems with manufacturing people and machine tool engineers.

In many cases, co-operative efforts have resulted in minor design changes or additions that have saved thousands of dollars in capital equipment, made automatic production lines possible, and reduced unit cost of the functional part.

Cost-Price Squeeze Forces Product, Production Trends

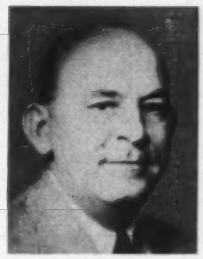
Everett M. Hicks—This can be expected to be another year of severe competition in metalworking generally and especially in the machine tool industry. Any company wanting to survive the cost-price squeeze and the inroads of foreign competition must concentrate on cost reduction and the introduction of new and improved products. An example of such developments is the recent major advance in the rate of production by grinding. It results from the introduction of higher wheel speeds and higher table speeds for most production grinding operations.

We are hopeful that the new administration and Congress will pass depreciation reform legislation needed to encourage capital expenditures for modernization and cost reduction. This is one area where we badly lag our foreign competitors, and our industry needs more liberal depreciation if we are to compete successfully in the cold war.

Predicts Coming Need for 'Compact' Machine Tools

James H. Flanders—The time has come for a re-examination of the standard machine tool. During the fifties, startling

WALTER K. BAILEY
President
Warner & Swasey Co.
Cleveland



G. M. STICKELL
President
Landis Machine Co.
Waynesboro, Pa.

RALPH G. LAGERFELDT
Executive Vice President
Colonial Broach & Machine Co.
Detroit

ALAN C. MATTISON
President
Mattison Machine Works
Rockford, Ill.

advances were made in sophisticated automatic metalworking equipment—both in high volume automation and low volume tape control. But changing circumstances have not outmoded the standard machine tool.

An analogy can be drawn between the standard machine tool market today and the automobile market in the fifties. European car manufacturers recognized that the basic need was economical transportation, so the small European car was able to penetrate the U. S. market to a substantial degree. However, once the basic situation was recognized, U. S. manufacturers responded in strength and depth with compact cars.

In the same way, U. S. machine tool manufacturers can and will recognize that our basic market is economical metalworking and that alongside the sophisticated new machine tools, there is a place for the metalworking equivalent of a compact car.

Investment of Millions in Machine Design Significant

Walter K. Bailey—The machine tool industry is entering 1961 with the most highly improved designs it has had for a number of years. They show the concrete results of the millions of dollars builders have invested in designing more productive machines, both numerically and mechanically controlled.

The amount invested in design is significant for two reasons:

First, it does not look as if 1961 will be a year of general plant expansion, and therefore most metalworking manufacturers will be looking for cost saving rather than expansion machine tool equipment. More cost saving is available than has been in the past.

Second, 1961 will continue the recent turnabout in our industry's position in world markets. General purpose machine tools, such as our own automatic and hand turret lathes, will once again be exported in some volume. Long deliveries currently being quoted by European machine tool manufacturers contribute to that, but a growing lack of skilled help (especially in Europe) has increased the pressure for production from the skilled men who are available. That means a growing need for the recognized increased productivity of U. S. machine tools, and our own growing foreign orders are a reflection of that need.

STANDARD MACHINES

Thread and Form Rolling Offer New Potentials

G. M. Stickell—The cost saving potential in producing screw and worm threads, gears, and similar forms by the chipless machining method will not be overlooked by alert metalworking managers in 1961. The principal advantages of the method lie in astonishingly high production rates, improved surface finish, savings in material, and improved physical characteristics through cold working.

Recent developments, both in techniques and in thread and form rolling machines, make available to industry the capability to process workpieces up to 6 in. in diameter, with hardnesses and tensile strengths heretofore considered impractical for cold forming.

Generally, parts employing standard screw threads can be processed on thread rolling machines without any design change. However, worm threads, gears, and similar forms designed for cutting and grinding sometimes do not lend themselves to the rolling process without a minor design change. Invariably, the advantages to be obtained from rolling such parts are so great that the design change is warranted.

Broaching Machine Maker Cites Precision Performance

Ralph G. Lagerfeldt—Far greater accuracy is being demanded of internal broaching operations, such as plain round holes, involute internal gear teeth, and helical internal gear teeth. That means broach travel must be in perfect alignment, guided through the entire length of the stroke. A recent development in pull-down broaching machines makes this possible.

Another important trend is toward the performing of two operations in one machine, as on the twin ram, pull-down machines. This type of machine is also advantageous for two-pass operations.

In addition to those new machine types, broader lines of mechanical machines incorporate the extreme accuracy demanded for such parts as jet wheels and blades. The machines are of a selected caliber with special ways and extreme accuracy built in.

Surface Grinding Abandons Some Old Restrictions

Alan C. Mattison—Stock-removal surface grinding is moving ahead fast as a result of increased understanding by industry of its inherent economic advantages. Limited connotations of the process (traditionally associated with extreme accuracy or fine finish) are under evaluation by engineers who are looking for much more than paper clip savings.

Recent wheel improvements have been paralleled by machine changes which greatly increase their capabilities for stock removal. Automatic spindle tilting has spotlighted wheel geometry. By reducing the number of grain contacts per inch per minute, it is now possible to keep wheels open and self-dressing in the stock-removal cycle. Accuracy phases of the cycle are quickly accomplished in con-

Machining

WALTER S. PRAEG
President
National Broach & Machine Co.
Detroit

RALPH E. CROSS
Executive Vice President
Cross Co.
Detroit

HOWARD N. MAYNARD
President
Snyder Corp.
Detroit

junction with sparkout. That boosts production 50 per cent or more without sacrificing any of the finish or accuracy advantages of surface grinding.

In precision horizontal-spindle grinding, major advances have been in machine control, preventive maintenance, and accuracy. It is not uncommon for customers to talk millionths of an inch. That requires machines in which the influence of heat and harmonic vibrations are minimized. Sensitivity of downfeed and resistance to deflection also have undergone development.

New abrasive belt machines produce higher accuracy and finer finishes by the straight-through and reciprocating method. A new, three roll head makes it possible to combine optimum belt flexing, constant belt tension, and vibration-free belt contact. The over-all design cuts floor space requirements by about 50 per cent.

As a result of those improvements and emphasis throughout industry on operations research, the intrinsic economies and technical advances in surface grinding will stimulate capital equipment expenditures. Rule-of-thumb criteria for selecting the process, such as stock allowances, piecepart design, and casting methods, are being abandoned by progressive companies in favor of cost-per-piece analysis.

AUTOMATIC PROCESSING

Automatic Loading Enhances Gear Finishing Equipment

Walter S. Praeg—Users of gear finishing equipment are beginning to put more emphasis on ease of loading of parts into gear shaving and gear tooth honing machines. One result: Maximum ease of loading and unloading a shaving machine for gears up to 24 in. in diameter has been provided by the application of a new, tunnel type column design used in conjunction with an extended base and deep worktable.

Automatic loaders for both shaving and honing machines are being equipped with additional mechanisms that ease feeding of parts through gaging devices into feed chutes and unloading of parts at the front of the machines.

Gear producers continue to show great interest in the gear tooth honing process. New, compact, lower cost models of gear honers have helped to stimulate interest. The honing machines provide four separate methods of accurately finishing the teeth of hardened gears to improve sound quality.

Pot type broaches that produce accurate external teeth, splines, and forms on parts are evoking much interest as the result of a machine especially developed for this application.

Transfer Machines Outgrow Traditional Concepts

Ralph E. Cross—A vital change has taken place in industry's concept of the function of transfer machines. As a result, today's transfer machines are vastly different from those built only a few years ago.

Originally, they were accepted as a simple and effective way of combining related operations. Today, industry has come to think of them in terms of complete processing. We now combine all kinds of manufacturing operations on transfer-matics. Every major type of machining operation is being done. We are automatically inspecting parts between stations. In-process storage and demand feeding have become integral parts of sectionized automatic transfer lines. We have added assembly operations, including those requiring heating and shrink fitting.

There is a new concept too as to what the transfer principle permits in product precision. Not only can individual operations be held to tolerances at least as close as those on specialized individual machines, but the relationships to each other of machined surfaces—internal and external—can be held to closer limits than with nontransfer processing.

Today's changes in part design and materials are anticipated by the builders of transfer machines. We can give the user almost any needed range in dimensional capacities for future flexibility. We can add, subtract, or interchange operations, as needed, and we have raised the over-all productive efficiency of transfer machines to a point not believed possible even a few years ago.

Transfer-Type Automation Finds New Markets

Howard N. Maynard—The application of transfer type machines to the definning of iron castings evoked much interest last year in a new market area. In the future, when foundries will be facing much competition from diecastings (particularly in the engine block field), it will be necessary for them to exploit automation concepts to the maximum to maintain and strengthen their present cost advantage.

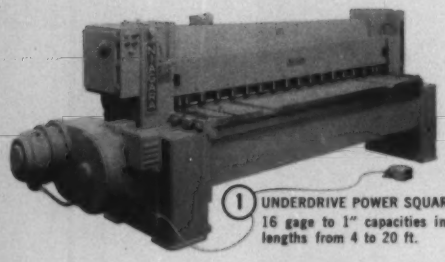
The electronics field is also becoming an active user of more automated machinery now that transistorized, plug-in assemblies have reached quantity usage in both military and numerical control systems. Automatic soldering machines that flux, solder, and clean the assemblies in a continuous process are indicative of the trend.

Now that the missile program is building up, there are some components, such as missile wings, that are made in sufficient quantities to warrant the consideration of automated equipment. One such special milling machine put into operation this year has resulted in significant production cost savings.

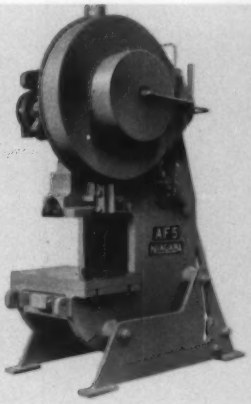
The transfer machine is also being applied by the appliance industry. Early this year, a production line using both rotary index and transfer type, automated machine tools will begin producing refrigerator compressor housings.

The bulk of the inquiry for automated

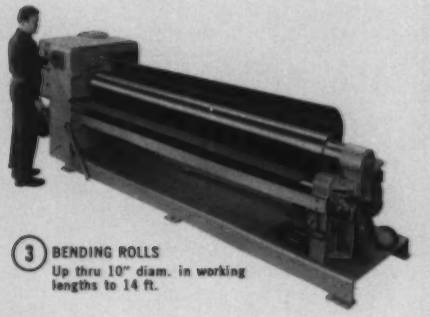
Talk about modern metal forming machines and shears...



1 **UNDERDRIVE POWER SQUARING SHEARS**
16 gage to 1" capacities in lengths from 4 to 20 ft.



2 **SINGLE CRANK OBI PRESSES**
5 great lines with 3 great clutches: air friction, air sleeve, and mechanical. 5½ thru 250 tons, 1¼" to 7½" diam. shafts.



3 **BENDING ROLLS**
Up thru 10" diam. in working lengths to 14 ft.

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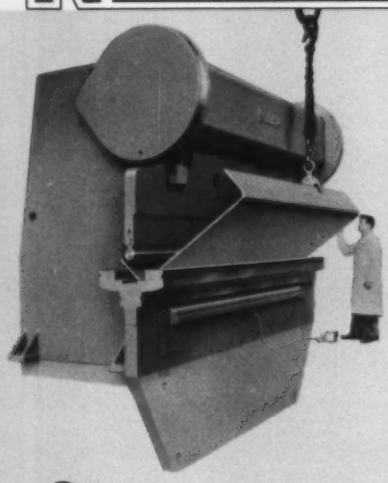
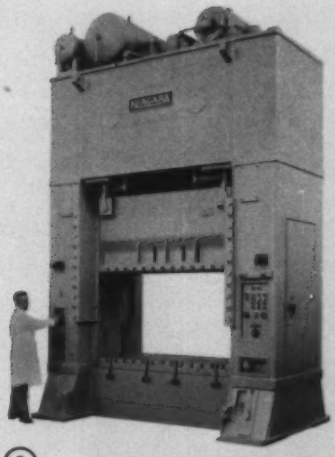


4 **MECHANICAL PRESS BRAKES**
15 thru 1500 ton capacities



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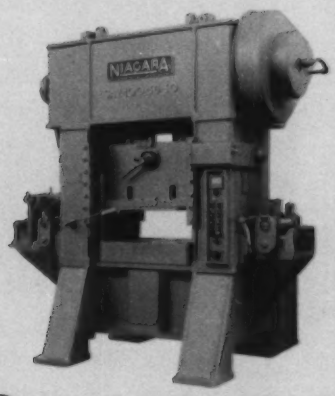
One, two, and four-point suspension. 100 thru 1250 ton capacities



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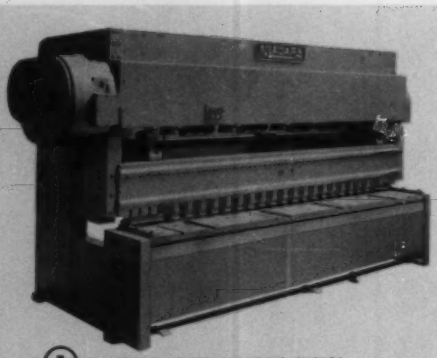

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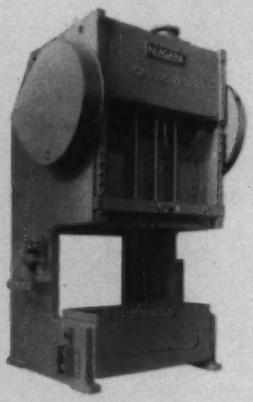

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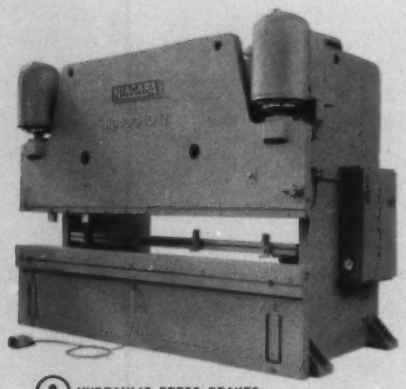

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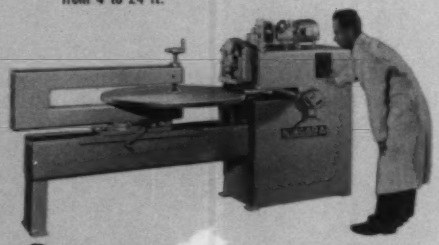

10 RING, CIRCLE SHEARS & FLANGERS
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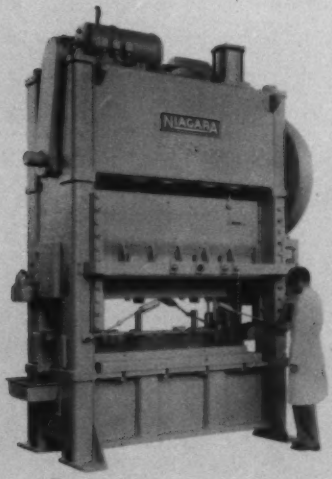

12 STRAIGHT SIDE SINGLE AND DOUBLE CRANK PRESSES
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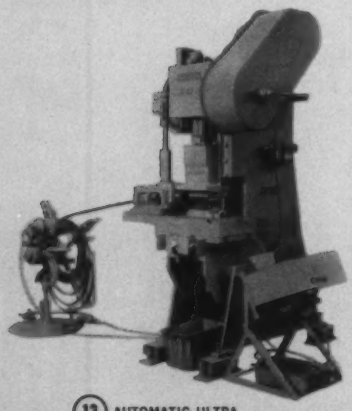

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17 GROOVERS AND SEAMERS

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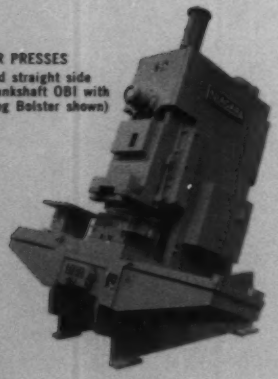

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special machines is in the area of the lower production types. The emphasis in transfer machines continues to be on the use of building block standards and the inclusion of auxiliary operations, such as assembly, precision boring, and precision gaging in the transfer line.

Automatic Handling Will Spur Small Lot Broaching

E. H. H. Graf—Small lot broaching has not been given proper consideration. A great many jobs could be advantageously broached in small lots, using a continuous broaching machine, the basic price of which is reasonable.

On vertical machines, economies are possible if you provide such things as interchangeability of main holders, subholders, and fixtures. When setting up a job for a short run, the holders should all be numbered so that they fit into their proper keyways on the main holder and the fixtures should all be set on a base plate and numbered so that they always go back in the same position. A great deal of setup time can be eliminated that way.

Further, as we progress along the lines of automatic handling, small lot broaching becomes even more attractive.

Gearmaking Said to Be Ideal for Automation

M. R. Anderson — Gear manufacturing probably lends itself better to small lot or large scale automation than any other type of machining. In the gear field, it is possible to use just as much or just as little automation as is economically sound. For large scale automation in the mass production of individual gear types, the various machines (for cutting, shaving, and checking) are designed for complete integration through connecting conveyors. Individual machines have demand feed loaders and automatic ejection.

Where lots are small and changeovers are frequent, the newest gear production machines are designed for minimum setup time and maximum ease of loading. On new shavers, for example, practically the entire setup can be done by setting dials. Once set, cycling is automatic.

Automatic dressers tied in to the machine cycle are available on both gear grinders and hard gear finishers. We've even provided for automatic control of cutting tool changes. If a shaving tool becomes dull, the machine stops and signals the operator.

NUMERICAL CONTROL

Transistors, Printed Circuits Reduce Size and Price

H. G. Bixby—Several new trends in controls and machines will influence applications of numerical control in the immediate future.

Control systems are being simplified and reduced in size and price. In some of the more sophisticated, continuous-path-controlled machines we have designed and built, the cost and size of the controls were about equal to the cost and size of the machine. However, through the use of transistorized systems, printed circuits, and an accumulation of production experience, both the size and price of control systems are being reduced.

Another development promoting the use of tape controlled machines is the shrinking of tolerances, especially in the fields of atomic energy, rockets, and missiles. We are building machines in which yaw, pitch, and roll of slide ways must be collimated and have no more than 1 second of error to the extreme limits of travel. Work spindle runout must not exceed 25 millionths of an inch 10 in. from the spindle nose. The tool path must be accurate within ±0.001 in. of the form programed on the tape.

Tape Necessitates Changes In Financing, Service Plans

Ralph J. Kraut—The market for continuous path, numerical control is much more limited than that for the point to point controls. Even so, the manufacture of dies for the automotive, forging, and many other industries is a current example of the use of continuous path, numerical controls. Another area in the continuous path field will be the manufacture of mathematical shapes for solid fuel, rocket components; for atomic reactor parts; for hydrafoils and propellers in the development of higher marine speeds; and for objects where styling is important.

Point to point applications of numerical machine tool controls are legion and are particularly important in the elimination of the extremely costly and "design-freezing" jigs, fixtures, and special tooling that our manufacturers have become so accustomed to.

Numerical control will, of course, be used on the assembly line, on inspection, and other related manufacturing processes other than those applicable to metal cutting or metal forming.

Financing, servicing, and other related practices and policies require review and

(*Please turn to Page* 204)

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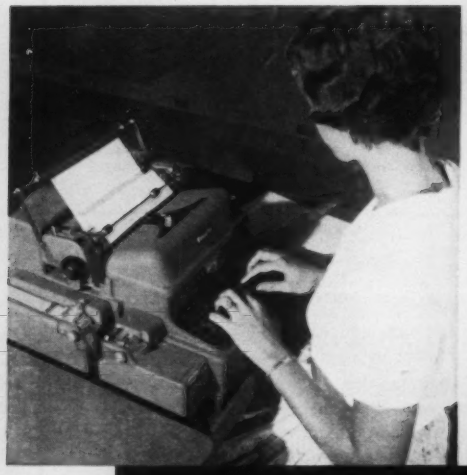

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Vertical boring and turning machines — 32″ to 20′ table sizes — positioning or contouring control.

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Radial and precision drilling machines — with 2-axis Numeripoint control positioning tables — sizes to suit job requirements.

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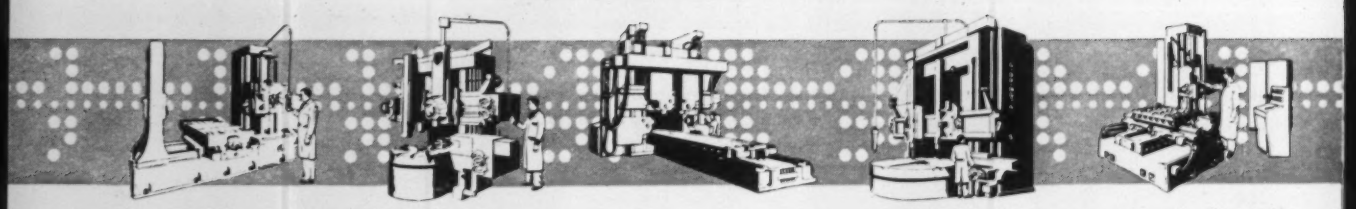


TAPE CONTROL "PACKAGE"

Machines. A complete new line designed and built to be operated under numerical control — horizontal boring, drilling, and milling machines . . . vertical boring and turning machines . . . combination jig borer-milling machine . . . contour milling and die sinking machines . . . positioning tables . . . planer mills.

Controls. The system of your choice, including Numeripoint* and Numeripath* controls of G&L design and manufacture to give you maximum productivity in point-to-point positioning or path machining, plus guaranteed responsibility vested in a single supplier.

Tape control training. G&L trains your operators when the machine is installed, teaches existing personnel how to program and prepare tapes, provides in-plant instruction of your maintenance men and conducts service training schools at Fond du Lac.

Reference material. Programming and control manuals thoroughly explain the equipment and procedures.

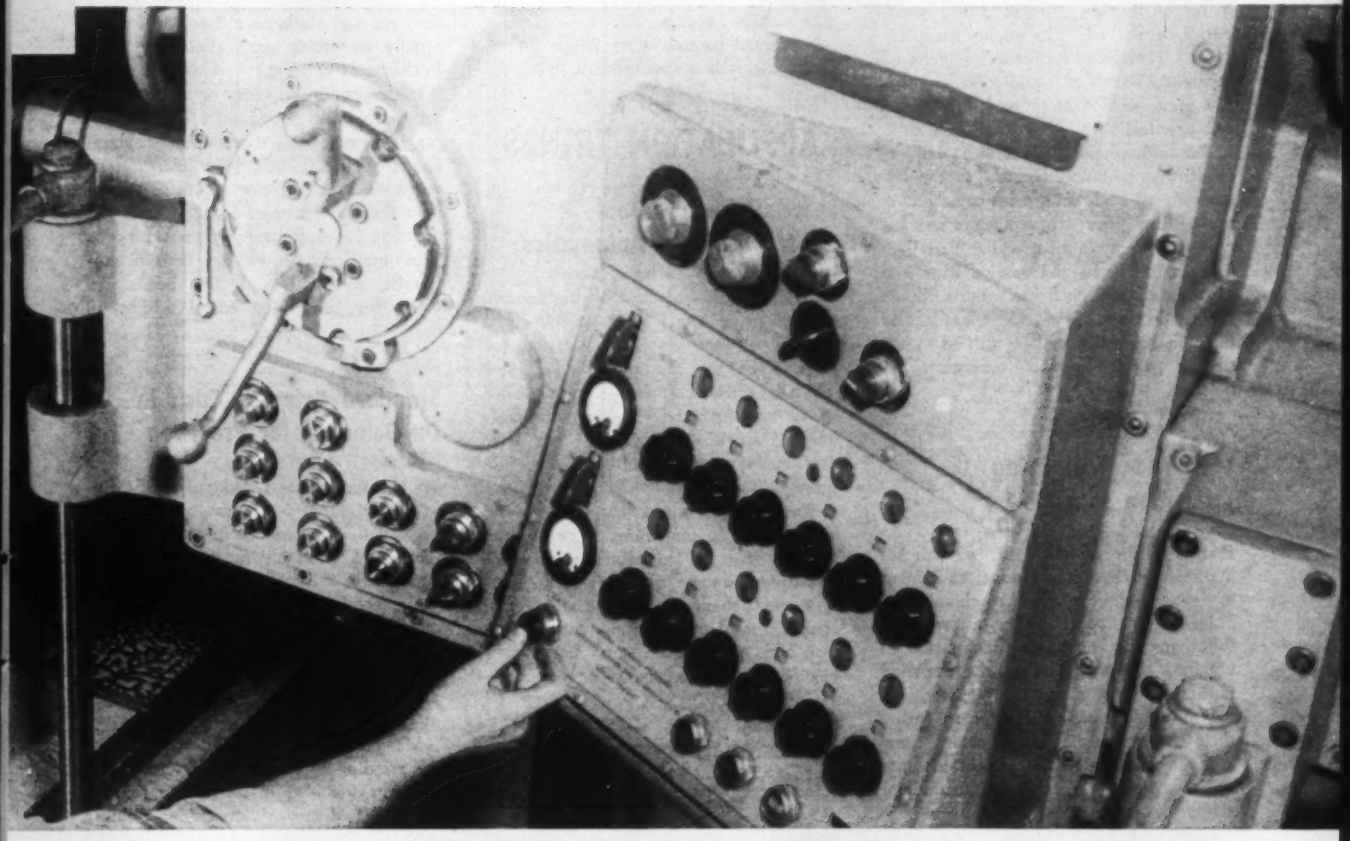
Cutting tools and toolholders. Davis pre-size VBM and VTL tooling . . . boring tools . . . arbors, sleeves . . . continuous-feed facing heads . . . tapholders for machines without thread leads . . . and special tools.

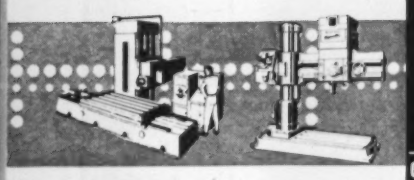
Accessories and attachments. Rotary tables, angular milling attachments, box-type angle plates, V-blocks, stop and jack blocks, measuring devices, and other equipment for speeding setups and production.

Consultation. Giddings & Lewis built the first commercially available tape-controlled machine tool, has shipped more types of major machines with numerical control than any other builder, uses tape control extensively in its own shops. This experience is available to help you justify, select, and apply numerically controlled machines for maximum manufacturing and economic benefits.

Ask for details and literature.

*Giddings & Lewis trademark





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T61-1

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(*Continued from Page* 201)

change. Numerically controlled machines and equipment are expensive; hence the matter of finance becomes a real problem, particularly for the smaller manufacturer. Therefore, facilities for deferred payments, rental of equipment, and the like must become more readily available and practical.

The old concept of service will be difficult to maintain because, in the last analysis, all such costs must come out of the selling price. Manufacturers using numerical controls must realize that their own maintenance and service costs and capabilities will increase. Furthermore, service contracts providing scheduled maintenance could well be utilized by the smaller shops to achieve greater efficiency.

This Year Will Bring Transition to Tape

Francis J. Trecker—In 1961, we will see a transition from conventional equipment to numerically controlled machine tools. I believe the year will be a period of solidifying the knowledge which has been obtained thus far. It will be a period during which those now using numerically controlled machines will come to realize their true worth and during which those who have indicated they might get into this new field will exchange intention for action.

Startling advances in the technical aspects of the machines or the controls are in prospect. We face a period of intensive investigation of the tools which are in use to determine productivity.

Predictable productivity is what the hard-shell shopman demands and here's where the knowledge, experience, and background of the manufacturers of both of the electronic control systems and the machine tools will play an important part by assuring the user the fullest possible reliable benefits.

Numerical control is no longer an experiment. It is a management tool.

APPLICATION TRENDS

Less Idle Time Is Goal On Multispindle Automatics

H. P. Chaplin—More tool application, in a given time and space, and less tool idleness between applications have for years given the multiple spindle automatic production appeal. But, as faster speeds and feeds have made more profitable a tool's working time, they have also made more unprofitable tool idle time.

The user can expect that the machine builder will do something, if he has not already done so, to minimize machine downtime in these major areas: Job setup and changeover, perishable tool change, machine lubrication, coolant control and maintenance, and stocking or bar loading the machine.

Hydrostatic Bearings Help Grinders Tighten Tolerances

Henry D. Sharpe Jr.—Demand continues for machine tools to produce cylindrical parts to extreme accuracy. As size tolerance becomes smaller, the need for true geometric form becomes greater. Size to 10 millionths of an inch becomes meaningless if out-of-roundness is 40 millionths. On dead center work, roundness can be controlled by true centers and center holes, but there have always been problems on line center work. The hydrostatic bearing has given us a breakthrough, and we believe they will have a rapidly increasing use on machine tools in the next five years.

High pressure pockets or pads of oil support a headstock spindle. The oil supply is so controlled that minute displacements of the spindle cause increases or decreases in the pocket pressure to oppose the displacement. Spindles with hydrostatic bearings have shown excursions from true position of less than 5 millionths, and with such line headstocks, work can be ground round within 10 millionths.

Standard Grinders Cash In On Demands for Precision

M. A. Hollengreen—Development of cylindrical grinding machines which finish parts within tolerances in the low millionths of an inch range has brought about new features which contribute to the general improvement in equipment for major users of cylindrical grinders. We regard close tolerance grinding as better roundness, straighter work, and improved size control. These may be grouped as increased unformity of parts.

Many of the fundamental requirements for grinding to low millionths tolerances are now included in standard machines. Examples: Increased machine stability achieved by isolating heat producing elements, such as hydraulic oil, from the machine proper; wheel feed systems that are more precise and under better control.

Wheel dressing, both straight and profile, is receiving more attention as a basic requirement for close tolerance grind-

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President
Gisholt Machine Tool Co.
Madison, Wis.

ing. Demand for dressers which will dress an exact profile without cut and try modification of profile bars is increasing. Such dressers improve quality, save downtime, and lower diamond costs.

Costs of equipment and tooling increase as tolerances are reduced below the commercially accepted standards. For extremely close tolerances, as an example, sizing gages and other necessary accessory equipment can become a substantial part of the total price.

Broaching Stakes Its Claim In Short Run Production

Joseph P. Crosby—Attempts to develop small lot broaching constitute a significant trend. The interest of tool engineers from the smaller shops in that type of broaching is most gratifying.

For some machining operations, such as the splines in gears, broaching is the only practical machining method, but in many other machining operations the process engineer must choose the method that is most practical. Today, broaching can be used economically for small lots as well as large production pieces to obtain excellent surface finish and repetitive accuracy. The broach industry has developed economical machines with the rigidity that is essential for all broaching operations.

General purpose workholding fixtures will take a variety of parts with a minimum setup time. A slab broach can be used for a wide variety of parts where flat surfaces must be produced.

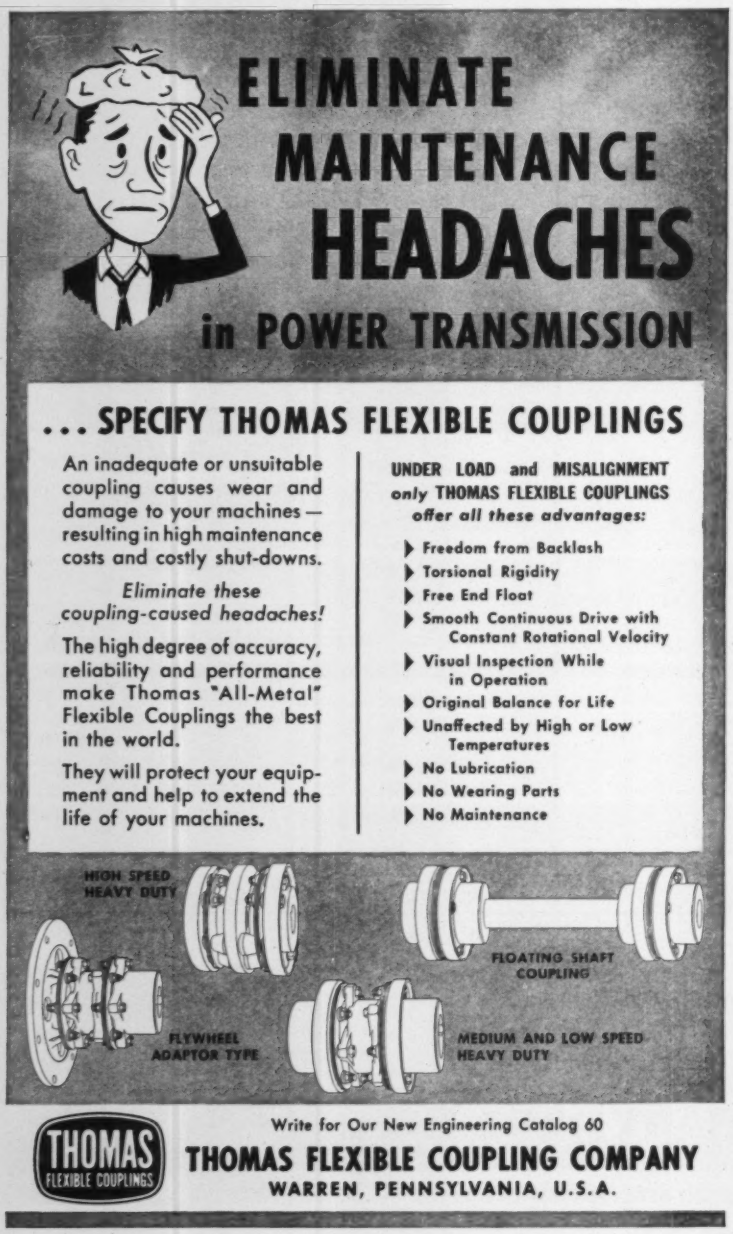
For internal broaching, it has been shown that a machine selling for less than $1500 can broach a wide variety of formed holes with a stroke of only 12 to 15 in.

You Can Get More Work From Standard Machines

George H. Johnson—To fully utilize the technology built into the modern, standard machine tool, metalworking managers face several important tasks. The challenge: Careful application of manufacturing processes to greatly expanded machine capabilities.

An appraisal of maintenance personnel and procedures relative to the increasing application of electricals, electronics, and hydraulics will be of mutual advantage to the user and machine builder.

The flexibility of the modern standard machine tool also should be taken into consideration by engineering departments. Time and money can be saved in the design of similar parts to fully utilize the reliable contouring and tracing capabilities of the modern machine tool.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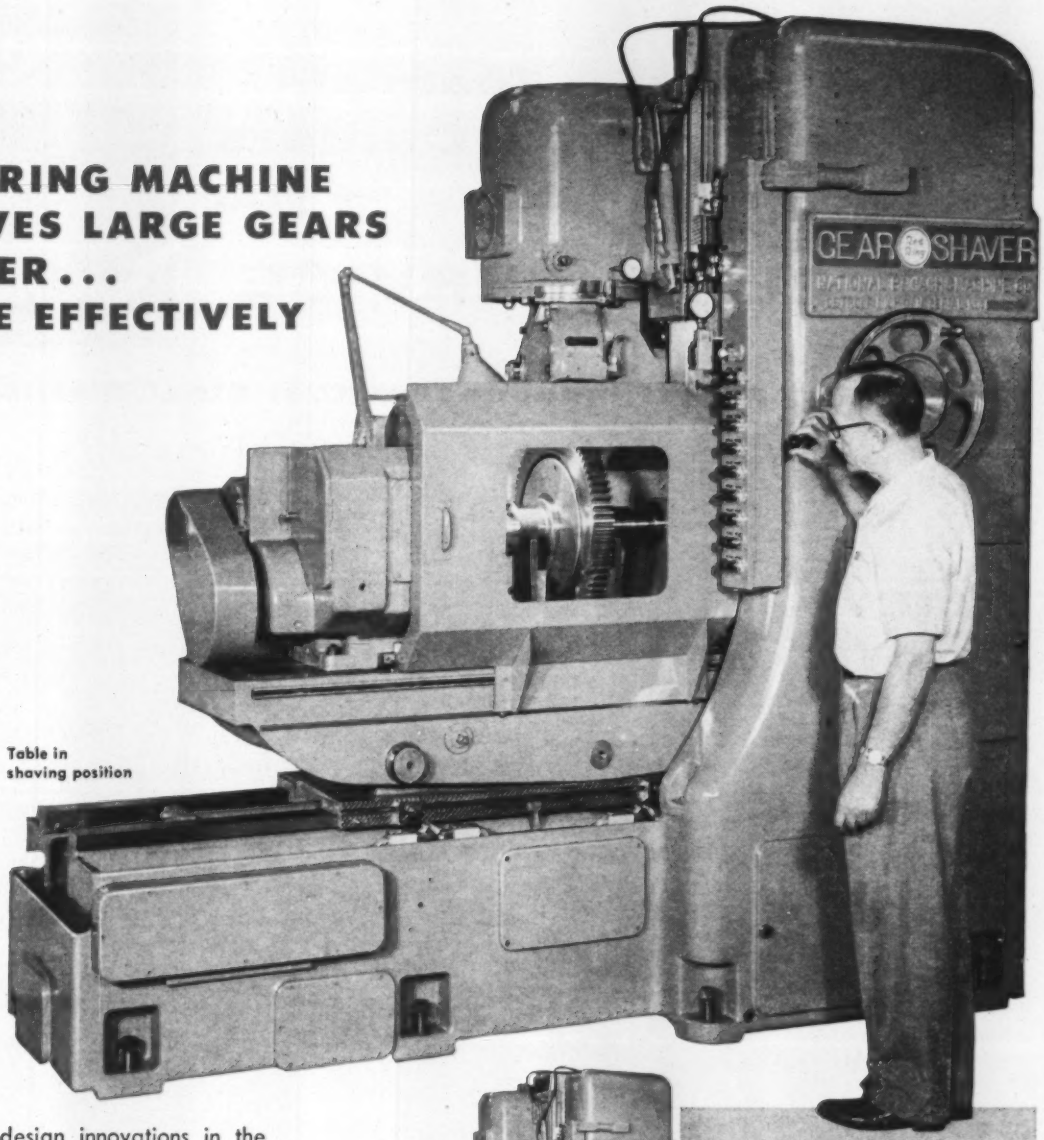
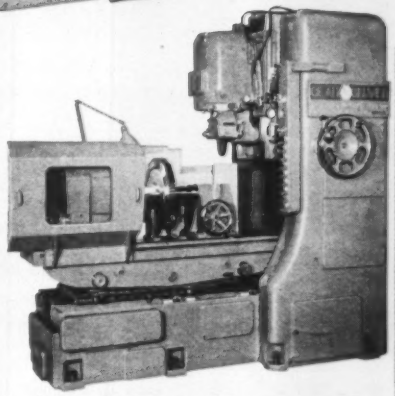


Table in shaving position



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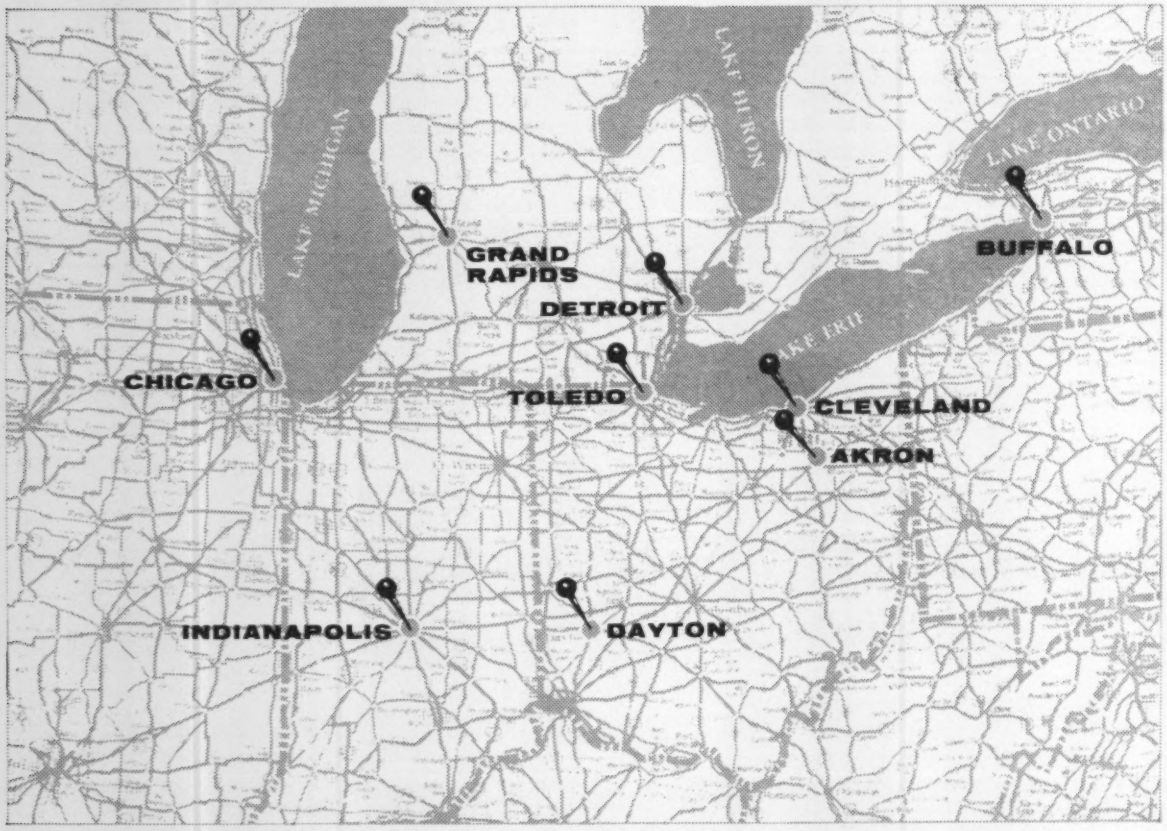

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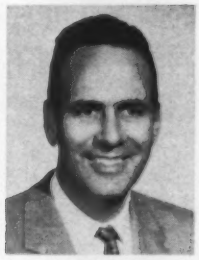

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President
Furane Plastics Inc.
Los Angeles

HARRY E. CONRAD
Executive Secretary
American Society of Tool & Mfg. Engineers, Detroit

TECHNICAL PROGRESS

Tooling and Gaging

Stronger ceramic tools, refinement in inserts for milling cutters, and new carbides are on this year's list of significant developments

Carbides Seen Growing as Tool, Structural Materials

Philip M. McKenna—Time saving in metal cutting by the use of quickly replaceable, hard carbide, cutting inserts with multiple cutting edges, introduced a few years ago, continues at an accelerated rate. Recent developments include precision ground inserts and blanks with tolerances of ±0.0005 in. The same principle is also being more widely adopted on adjustable head boring bars for precision work.

Boring bars of cemented tungsten carbide have resulted in greater economy and accuracy of work due to the high rigidity of tungsten carbide, three times that of steel. Bars ranging from 1 to 5 in. in diameter, and up to 5 ft long, are being increasingly put to work. The higher rigidity of grinding quills of tungsten carbide is being used to equal advantage.

Face milling cutters having heavy tungsten carbide wedges, constituting anvils behind harder grades of cutting inserts of the indexable type, are being introduced in 1961.

New Standards Will Aid in Maintaining Superprecision

Louis Polk—Among the accomplishments of the recent International Conference on Weights and Measures were the new light wave standard of length based on Krypton 86, and establishment of a standard second based on the tropical year 1900.

The precision with which those standards are associated are, of course, several orders removed from those of the tolerance with which we are generally concerned in manufacture today. Yet, I am sure that we are making good progress in the higher levels of standards, and I think such progress will put even more reality into the concept I have always expressed: "Man's industrial progress is linked to his increasing ability to divide his unit of measure finer and finer."

Nonmetallic Tooling Market Broadens

John Delmonte—For the long run production jobs, plastic tooling is accepted in such applications as welding jigs and fixtures. Semiresilient epoxy resins outwear metal counterparts as blowboxes for sand cores. Epoxy matrices have demonstrated superior behavior in supporting steel rules (in dies) over long production runs. As tooling aids for assembly and encapsulation of electric motors, glass reinforced epoxies have much to offer. Metal forming and drawing utilize plastics only for the short run operations in special circumstances.

We can look forward to the high heat resistant ceramics—like tooling used in the fabrication of special alloys for the B-70. Rubberlike components valuable for metal fabrication will be cast from flexible silicone, urethane, and polysulfide rubbers—all capable of curing at room temperatures.

Variety of Advances Spark New Tool Techniques

Harry E. Conrad—The development (and availability on a commercial scale) of

Tooling & Gaging

HARRY CONN
Chief Engineer
Skully-Jones & Co.
Chicago

M. S. DAY
Manager, Stupalox Ceramic Cutting Tool Project, Carborundum Co.
Niagara Falls, N. Y.

M. EUGENE MERCHANT
Director of Physical Research
Cincinnati Milling Machine Co.
Cincinnati

powder metal shanks for cutting tools may lead to major improvements in the life of present tools. The shanks, by damping vibration, prevent the transmission of shocks to the cutting tool that might cause chipping or breakage. The result is prolongation of tool life—perhaps to double or triple the life obtained without the shanks. It means that higher feeds and speeds can be safely used, or, in some cases, that sensitive ceramic tools and the harder grades of carbide can be applied—particularly with older machines.

Tool engineers show great interest in the heat treatable, machinable carbides for die and wear part use. The heat treatable carbides can be machined in the soft state on conventional toolroom machines, then hardened as required by the application. It is no longer necessary for a plant to maintain special facilities for machining carbide dies. As a result, an increasing number of plants are making their own carbide tools.

There is also a substantial trend toward making forging dies, diecasting dies and plastic injection molds as precision castings that require little or no machining.

There has been a great deal of interest in coatings for cutting tools, such as reamers and broaches, to give added tool life. Several newly developed molybdenum disulfide coatings appear to give outstanding results—two to three times the tool life obtained without the coatings has been claimed.

A new process for ultrasonically treating cutting tools to relieve stresses may mark a revolutionary development. Again, claims are made for double and triple the tool life obtained with untreated tools.

Tool Technology Seen As Real Cost Cutter

Harry Conn—New tooling for high production machines (which also include single and multiple spindle automatics) will enable users to obtain the low unit cost of high production techniques at low quality lot sizes. The economics of machining plainly indicates that quick changeover or low setup cost has the most effect upon short run unit cost. Tools that are quick changed and preset for the next job will eliminate cut and try and in-the-machine adjustment.

With new hydraulic holding tools, quick change and preset tooling, and automatic tool changing, optimum values will be achieved for lot sizes, tool life, output, machining velocities, and unit costs. Costs will be drastically reduced because more units will be produced and shipped via the current capital outlay.

CUTTING TOOLS

Higher Strength, More Sizes Give Ceramics More Potential

M. S. Day—Intensive development programs in the field of ceramic cutting tools are culminating in many new benefits to metalworking. Ceramic tools up to 30 per cent stronger than those now being utilized probably will be introduced this year. That represents a 160 per cent gain in strength over tools sold in 1957. New catalogs will list four times as many standard tools as formerly available. Economic purchasing quantities will also be outlined.

Engineering specialists who service both small and large shops in their ceramic tooling applications will emphasize milling cutter and interrupted cut applications in addition to the more common high speed turning operations. More complete data on cutting speeds and feeds are being developed to assist the consumer in choosing tooling and machines.

Recent developments in the technique of manufacturing intricate shapes and sizes will make possible the economical production of special tools, gage blanks, and wear parts in configurations that could not be fabricated by previous methods.

This should be a coming-of-age year for ceramic tooling. Continuing development programs will assure that ceramics will realize their full potential in the near future.

Difficult Metals Bring Need For New Tools, Techniques

M. Eugene Merchant—We are still near the beginning of a decade in which we will see swift and significant advances in our ability to machine difficult materials. The aerospace industries alone predict that by 1970 more than half their machining will be done by noncutting electrical and chemical methods. With the stiff demands for increased utility and performance which lie ahead for mechanical equipment of all kinds, many other phases of industry must also move toward increased use of more difficult metals, and be able to overcome the machining problems associated with them.

Two types of advances in ability to machine such materials can be expected: Extension of the capabilities of the conventional machining process (using edged cutting tools), and development of improved or new noncutting, alternative stock removal processes.

While such methods as elevated temperature machining, using highly localized heating ahead of the cutting tool, offer promise of improved capabilities in a number of types of operations, the greatest potential for significant improvement appears to lie in the development of new cutting tool materials having considerably enhanced resistance to shock, temperature, and wear.

The decade ahead should see the development of considerably increased performance and versatility in the already existing noncutting methods, such as electrodischarge machining and electrochemical machining, and also the development of still other new methods for stock removal, having their roots, perhaps,

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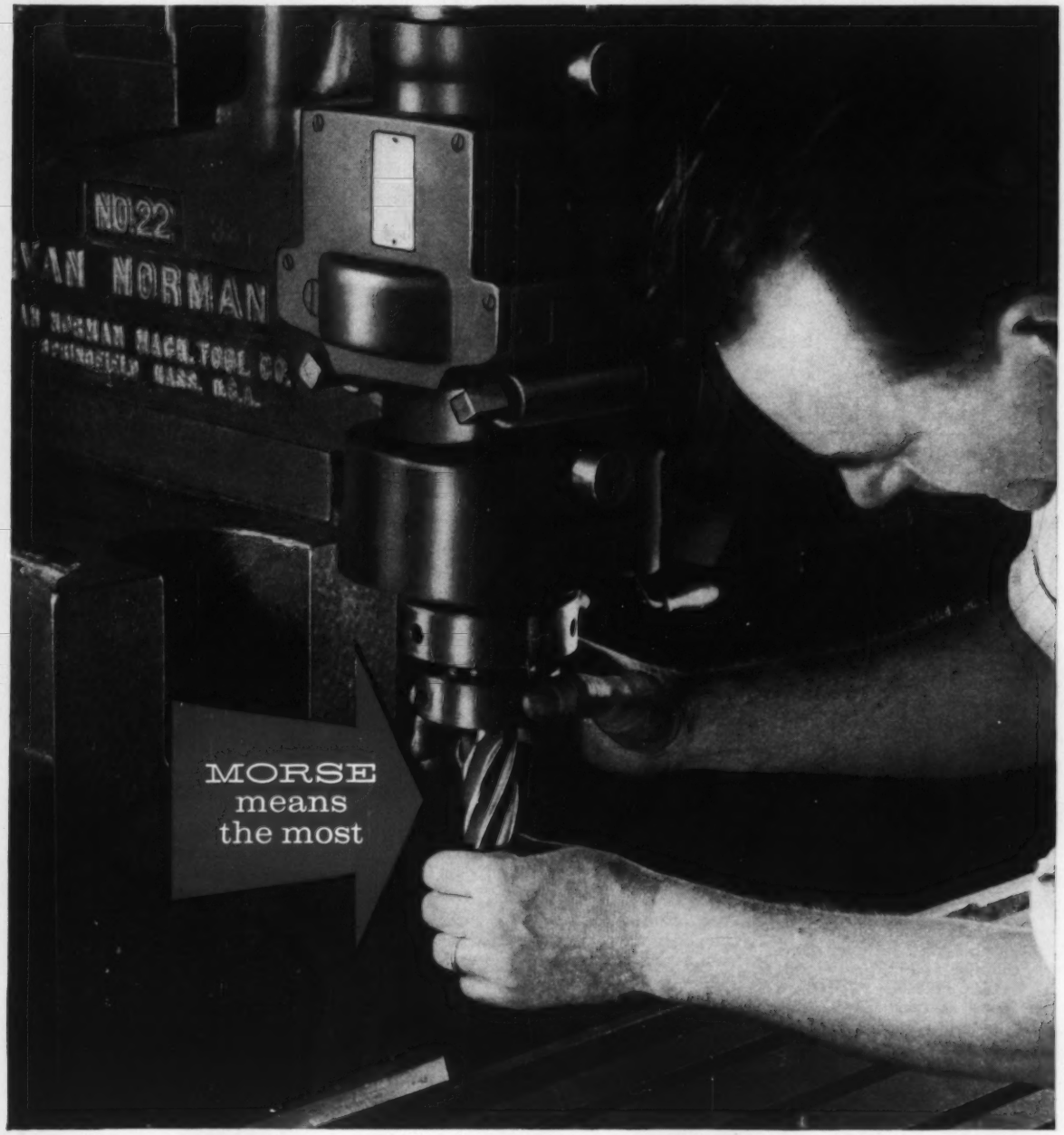

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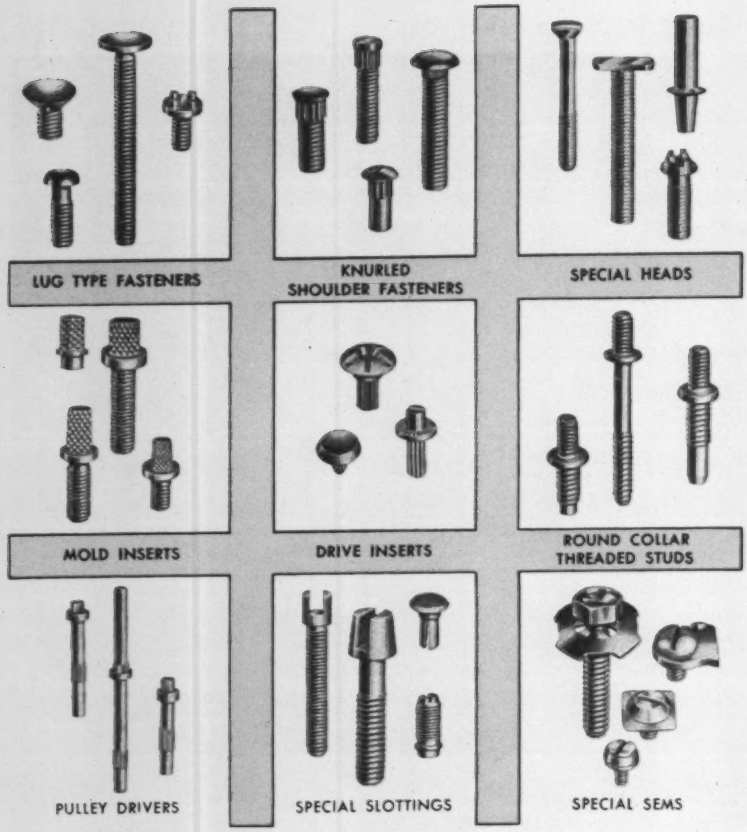

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Small fasteners like these Hubbell cold headed parts represent an area of saving often overlooked by management, who give careful attention to the cost and design of major components and little or none to the parts that hold them together. Yet here is the area where savings can be effected most easily and quickly.

Why pay for special tolerances and secondary operations when Hubbell engineers can design and mass produce a cold headed part that is stronger, cheaper and more uniform. For example, all of the above, and thousands more like them, have been specially designed for Hubbell cold heading. And each one helped to make the end product faster and better.

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in such phenomena as the plasma arc, shock waves, or the erosive action of ultrahigh velocity streams of liquid.

Ceramic Tools Grow Into New Jobs

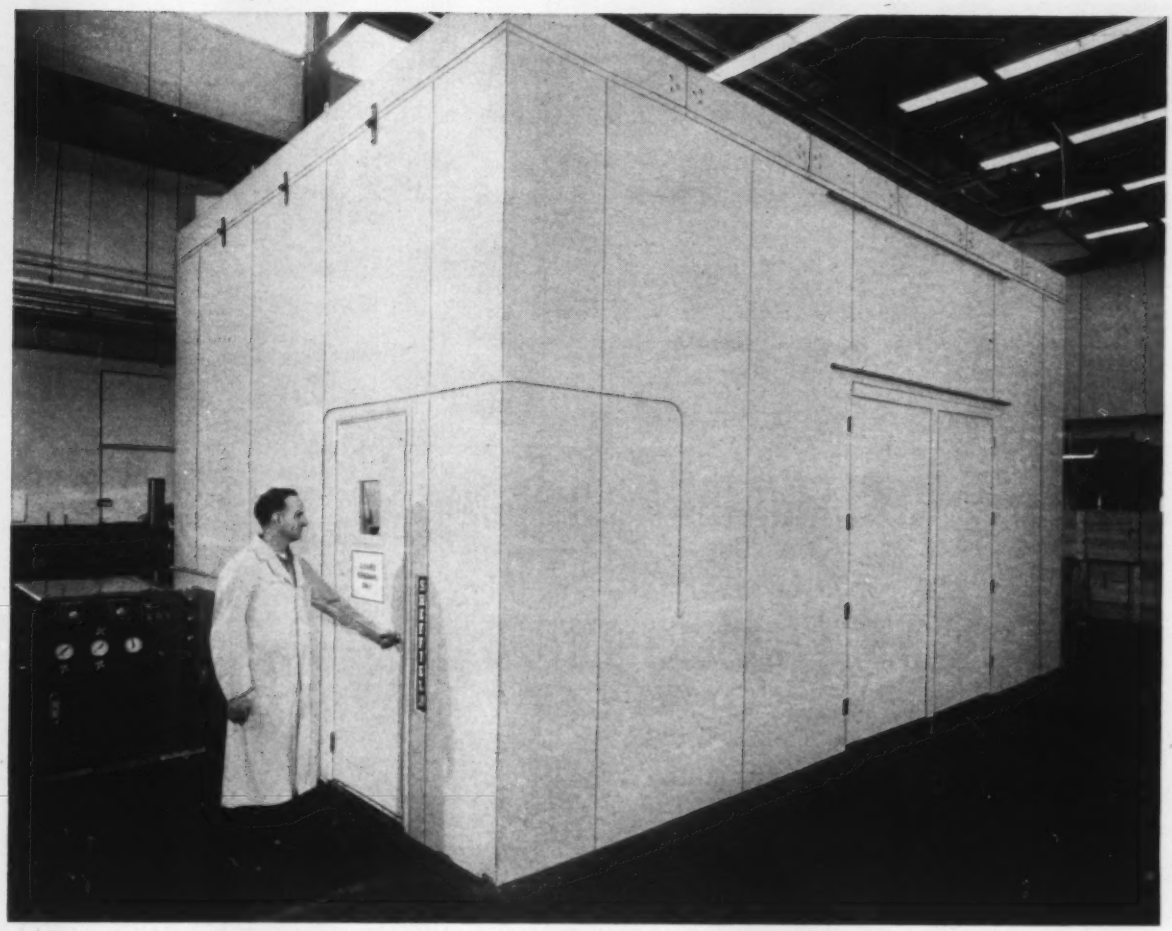
W. M. Wheildon—It is now recognized that ceramic tools can be employed to advantage of semiroughing cuts, as well as for light finishing. The skepticism accompanying the application of ceramic tools to the machining of metals has all but disappeared.

Only the machine capabilities and workpiece characteristics dictate how much can be gained by ceramic tooling. Industry is, of course, depending on the ceramic tool manufacturers to continue to improve the strength and other physical characteristics of the tools. The ceramic people in turn have begun to dig deeper into relationships between tool fabrication techniques, raw materials employed, and tool performance.

Ceramics are proved performers for cast iron roughing and finishing. Tool life for the application has increased severalfold, with increases in cutting speeds up to 3000 sfpm. Carbon and alloy steels are being machined with speeds of 500 to 2000 sfpm, feeds of 0.004 to 0.020 ipr. Many production applications are finishing cuts using small, throwaway inserts, but heavier cuts are machined with depths of cut to $\frac{5}{8}$ in. at 0.020 pir feeds.

Some high temperature alloys and stainless steels such as Stellite, Hastelloy X, and Series 400 stainless steels have been machined with ceramic tools with excellent results.

Heat treated alloys between 50 and 62 Rockwell C previously requiring grinding



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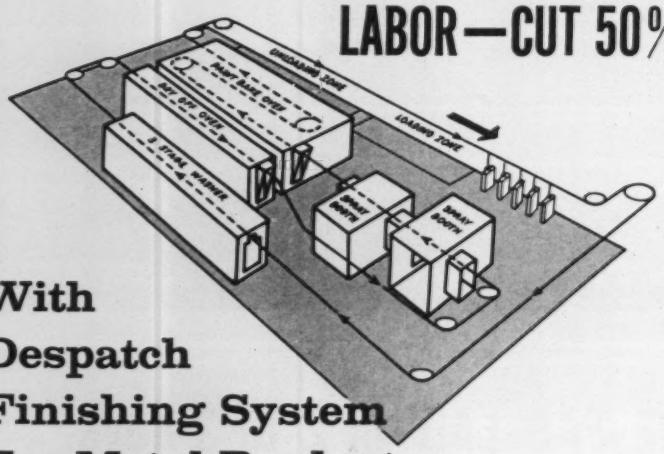

With Despatch Finishing System For Metal Products

The figures speak for themselves. Hoffman Engineering Corp., Anoka, Minn., reports that savings in production and labor costs alone paid for its complete new Despatch finishing system in only two years. And production was boosted 300% in the bargain.

The conveyorized system, designed and installed by Despatch engineers, not only produced these remarkable improvements but is capable of easy expansion in the future to match the company's growth.

Despatch's years of experience and imaginative engineering have produced solid results for this Minnesota firm and thousands of others. You can put these qualities to work for you, too. Let us show you how . . . write today! for free bulletin 100ED.

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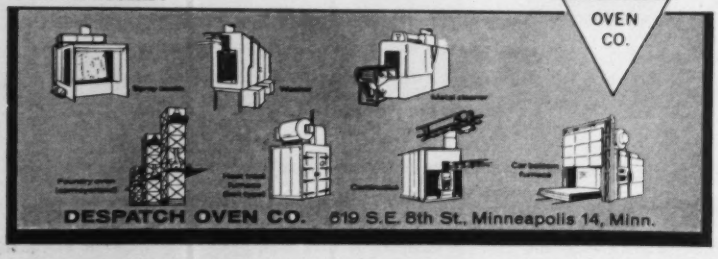

DESPATCH—INDUSTRY LEADERS FOR 58 YEARS

are now sized and finished by straight turns without difficulty.

A number of special tool geometries are under investigation, such as convex cutting edge lands applied by tumbling, which appear to have promise and will probably be more universally evaluated during the coming year.

Throwaways Augment, but Don't Replace Regrindable Tips

Ray W. Ruckel—With the big advances in the performability of tools using throwaway inserts for turning, milling, and boring, the question of where and when throwaways are superior economically to conventionals and vice versa has become one of the most important in metalworking.

A year ago, milling cutters with throwaways were not suitable for finish milling. That is no longer so. In boring, throwaways have facilitated the economical application of multiple point tools on a single body through the use of standardized cartridges. Better single-point holders have taken some of the problems out of turning with throwaways, have cut tool change time.

In contrast, there have also been marked improvements in regrindable tool types, particularly in the direction of increasing life.

There is no pat answer we can find that tells where and when a throwaway or a conventional carbide tool would give better results on a specific job. That is why we are continuing to produce and improve both types.

New Carbide Will Help Meet Challenge of Superalloys

M. J. Kuderko—The combination of high strength and wear resistance required in a tool material for machining superalloys has been achieved in a tungsten carbide grade being produced with new manufacturing techniques.

Since most superalloys are work hardening, extremely abrasive and possess high shear strengths, machining them requires a tool material which has both high strength and abrasion resistance. Extreme abrasiveness and high shear strengths call for good wear resistance in the cutting tool material. Concentration of stresses on the cutting edge, a characteristic common to the superalloys and unsupported cutting edges (the result of positive rakes necessary to provide better shearing action), call for high strengths in the cutting tool material. The new grade (VR-54) will be used to meet those challenges.

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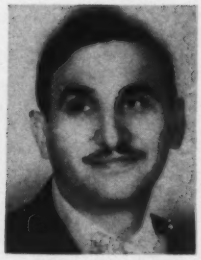

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TECHNICAL PROGRESS

Forming

Tomorrow's trends include: Teflon dies for stainless forming, more exotic metal forgings, much faster press speeds

Galvanized Forming Problems To Occupy Automakers in '61

M. F. Garwood—Some of the forming problems we will be facing during the coming year involve galvanized sheet metals which will come into increasing use for corrosion resistance—especially in the floor pan areas. So far, we believe that one grade better drawing stock is needed. For example, if you have been using drawing grade, you will almost certainly have to go to deep drawing grade (aluminum killed steels) in galvanized.

We also look for increasing applications of plastic-metal combinations in car interiors.

Cold Forming Will Continue To Show Significant Gains

J. K. Wingard—Pressworking and cold forming of metals will continue to be a fast, economical way to mass produce a wide variety of items. In particular, cold extrusion of steel and nonferrous metals will gain wider acceptance. Much of the mystery which seems to surround cold extrusion will disappear with increased application, research, and experimentation by fabricators.

Look for progress in: Improved tool materials, tool design, slug design, lubrication, and automation. Mechanical presses capable of exerting the rated load several inches above bottom stroke will be forthcoming. They will be designed to handle extrusions and cold forming.

Business Pressures Force Faster Press Speeds

C. C. Caditz—Increasingly difficult economic problems are behind present moves to increase press speeds. For example, we are looking for speeds of 350 strokes per minute even in presses rated at 50 to 60 tons. We are also converting our older presses to those high speeds by changing belts, motors, and gear ratios.

Prime reasons for those moves: Poor scrap prices (they are only half what they were, and we don't foresee any improvement before late summer, 1961). Tax situations locally may have some effect as well. (This year, we paid $13,000 more in unemployment taxes than we did last year.)

We also see increasing interest in cold extrusion. We are experimenting with the cold extrusion of a deep drawn shell which has been too difficult to solve with conventional deep drawing techniques.

Teflon to Get Increasing Play in Forming, Coating

Ross D. Pillsbury—Teflon fluorocarbon resins, already on working terms with metals, are destined to play even more important roles within the industry.

Inert to virtually all chemicals, capable of service in excess of 500° F and possessing a nonadhesive, low friction surface, such resins have been used for several years to line carbon steel. The economic advantages of protecting steel with Teflon are such that entire pipe systems with

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Verson Allsteel Press Co.
Chicago

CARTER C. HIGGINS
President
Worcester Pressed Steel Co.
Worcester, Mass.

J. C. DANLY
Vice President
Danly Machine Specialties Inc.
Chicago

D. E. KRANTZ
Senior Engineer—Research
Rocketdyne Div., North
American Aviation Inc.
Canoga Park, Calif.

resin linings are being planned.

Laminating sheet Teflon to metal can contribute the highly desirable properties of these resins to the structural properties of metals. Tanks, valves, and pumps with coatings of the new melt-processable resins may one day be commonplace.

In die forming parts of titanium and stainless steel alloys by using mating dies of a Teflon resin, Chance Vought Corp.'s Aeronautical Div. has cut its forming costs by one-third. Rough cut and confined in a universal steel box, the Teflon yields under pressure (up to 18,000 psi) to become a perfectly matched die. Parts are formed with 0.002 in. tolerances. Expensive die tooling is eliminated.

Among the first to capitalize on Teflon properties were makers of packing and gaskets. Now nonlubricated bearings; piston rings; and high temperature, nonflammable, electrical insulation are economic realities.

The steel industry is giving serious thought to more extensive applications of this plastic.

Moving Bolster, Cold Impact Are Dominant Trends

Melvin D. Verson—We are well on our way in the advanced fields of metal forming. The press of the future, equipped with automatic handling, is a reality. The only problem is its application and conversion from older methods to those which will give high production.

The automatic Transmat press combines multiple operations into one automatic unit. Such presses have increased efficiency and productivity as much as 200 per cent.

The moving bolster has a great future. It is simple and speeds tool setup tremendously.

We believe impact machining will continue to have an important effect in forming parts formerly produced by machining methods. It produces superior parts at high speeds. Our research and development center is dedicated to the future of the cold extrusion field. Many automated lines of presses and tooling point up the progress made in this new field.

Hot Work Die Steel to Get Increased Design Attention

Carter C. Higgins—We anticipate increasing interest in the coming year in H-11 hot work die steels. More will be specified for 800 to 1000° F service, especially in defense and space applications. We have successfully drawn and redrawn (with intermediate annealing) a 6 in. cylinder 1 in. in diameter in a mechanical press.

The present price of H-11 seems high, but we predict some decline as demand increases.

Our firm is also concentrating on the expansion of stacked stamping technology. We are finding the joining of multiple thicknesses with adhesives a satisfactory technique. Tensiles of 5500 psi are possible with careful cleansing techniques, but for production purposes, we can design around a less expensive norm of 3500 psi.

Adhesive joining is somewhat more expensive than rivets or spotwelds but less expensive than brazing. Advantages: Sections are impermeable (the adhesive is an insulator) and far easier to apply to thin, narrow sections.

Automatic Presses Gain Acceptance in Metalworking

J. C. Danly—Automatic die changing, which reduces changeover time to minutes, is shaping a new trend in metalworking. It is our experience at Danly that such automatic equipment is gaining acceptance throughout the industry. Sales of that type press have been primarily to foreign manufacturers, but, more recently, our automotive industry has begun to adopt them. During the coming year, we expect to see more U. S. manufacturers turn to such machines.

We also expect to see the quick die change principle adapted to other machines and processes which employ fixed tooling; for example, quick die change welding presses are now under construction.

Development continues in precision blanking and cold extrusion. Recent improvements in metallurgical control of microstructure will now permit extrusion of higher strength steels, while reducing tool wear. Precision blanking which can eliminate machining or shaving dies is certain to come into more general use. Coil fed, progressive die presses and transfer presses will continue to replace single operation dies. We also expect to see more mechanical handling equipment between presses and the use of synchronized press lines for increased production and efficiency.

EXPLOSIVE TECHNIQUES

Explosive Forming Fulfills Regular Production Need

D. E. Krantz—Explosive forming can now be considered a production technique. That is its status at Rocketdyne. It is based on four years of research carried on concurrently with the development of production methods for a great variety of metal parts.

In the future, many other high explosive methods will be developed. For example, these are now in research and development:

Forming of beryllium, tungsten, and

Forming

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National Northern Div., American Potash & Chemical Corp.
West Hanover, Mass.

ROBERT G. FRIEDMAN
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Technical Director
Wyman-Gordon Co.
Worcester, Mass.

C. H. SMITH JR.
President
Steel Improvement & Forge Co.
Cleveland

tantalum with explosive charges.

Cladding or bonding of dissimilar sheet or tube metals. (Applications: Lining of pressure vessels, tubing, or nuclear reactors.)

Explosively welding dissimilar metals.

Work hardening of metals. (Applications: Hardening of pressure vessels or solid propellent motor cases.)

Compacting of metal powders. (The high pressures available with explosives should give compacts greater densities than have ever been achieved conventionally.)

Punching and embossing of metal parts.

Such methods will increase the ability of the metal industry to solve many problems of the Space Age.

Compaction with Explosives Shows Great Promise in '61

Vasil Philipchuk—Explosive forming is being utilized by aircraft and missile people because of its convenience, cost reduction where odd tooling is concerned, and for its ability to fabricate parts hard to handle with conventional methods. Many fabricators continue to use specialist firms such as ours to work out technical data, techniques, and type of explosives for specific jobs.

Explosive forming technology, originally employed as a way to apply explosive energy to shape a part, has now grown into welding, forging, sizing, compaction, and hardening of metal parts or powders. The metals it handles encompass practically all of those available and many new ones just being prepared by laboratories.

Explosive compaction (forming parts from powders) appears to have the greatest potential for civilian use, particularly in electronics.

Automatic Hot Forging Shows Great Promise

Robert G. Friedman — Automation will play an increasingly bigger role in hot forging. Forging machines with automatic tong feeds have been production proved in seven sizes up to 7½ in. Parts from push rods to axle flanges are being forged automatically on such machines. Automatic press installations in leading automotive forge plants produce valves and other parts.

Cold forging will continue to spearhead the trend toward finished parts from wire. As speeds increase, costs will decline at no sacrifice to quality. Advanced multiple die, cold forming machines teamed with technological advances in wire manufacture, tool steels, and die lubricants, turn out parts formerly considered impossible. Machines and the parts they make are becoming larger and more versatile.

High speed cold heading is here. Difficult-to-make parts are produced routinely at 450 pieces per minute on ⅛ in. high speed cold headers.

The seamless aluminum can is still another area to watch. More and more thin walled impact extrusions, like cans, cases, covers, and other hollow components, will be produced automatically from nonferrous materials.

Trend to Heavy Forgings Includes Refractory Metals

Arnold L. Rustay—Over the next five years, we see a gradually increasing usage of large forgings, made of less common metals, in aircraft (civilian and military), missiles, and spacecraft. Much of that trend will be due to the success of large forging equipment, including the Air Force presses at our Grafton, Mass., plant, and the growing body of engineering knowledge being built up by those engaged in forging design.

Materials growth, we believe, will mainly center in the high strength alloys and the refractory metals. Current development programs indicate some success, particularly with columbium, beryllium, molybdenum, and tungsten. Such large forgings may well spell the difference between success and failure for some metals which are proving difficult to join—beryllium, for example.

Conventional forgings will move ahead mainly due to increased attention to new applications and quality control being paid by forging people themselves.

MISCELLANEOUS

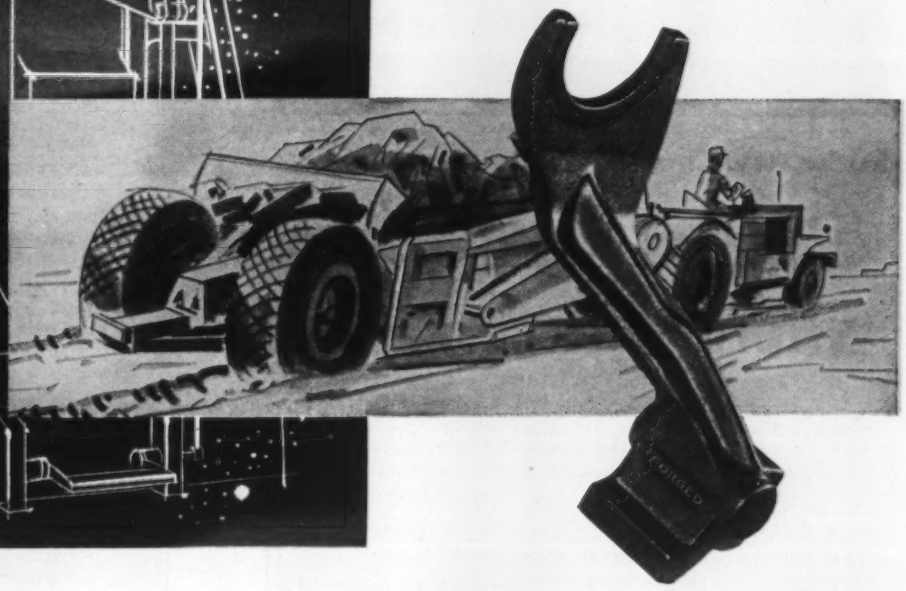
Electroshaping to Be Big In Forming Tough Metals

C. H. Smith Jr.—We are on the threshold of an important new era in metalworking. A new technique, called Electroshaping, permits us to remove metal swiftly and accurately from the most difficult metals.

The method permits us to shape raw forgings electrochemically into precise finished components in a matter of minutes —many times faster than is possible with conventional methods. Our Cleveland plants have already produced more than 15,000 jet engine turbine and compressor blades with 16 designs. Several would have been difficult, if not impossible, to produce any other way.

While the work so far has been concentrated on forgings, we see the new process being applied to castings and

DEPENDABILITY of shifter fork improved by designing it to be FORGED



Modern board forging hammer

By designing the shifter fork of his transmission to be forged, a manufacturer of earthmovers eliminated costly equipment breakdowns in the field because of fork failure. Factor of safety was *in*creased even while weight and over-all costs were being *de*creased.

Parts scrapped because of voids uncovered after much high-cost machining are eliminated . . . forgings are *naturally* sound all the way through. Forgings start as *better* metal . . . are further *improved* by the compacting hammer-blows or high-pressure of the forging process.

Design your parts to be forged . . . increase strength/weight ratio, reduce as-assembled cost, improve performance. Literature to help you design, specify, and procure forged parts is available on request.

When it's a vital part, design it to be FORGED

Drop Forging Association • Cleveland 13, Ohio

Names of sponsoring companies on request to this magazine

In the new Charles Bruning Co., plant...

a finishing department where efficiency is king

In equipping their new plant in Mount Prospect, Illinois, Bruning took full advantage of the opportunity to build new efficiencies into every manufacturing step.

Working closely with Bruning engineers, Binks designed a spray finishing system in keeping with every other advanced process incorporated into the plant.

The finishing system is completely flexible! The combination of conveyorized handling and manual spraying accommodates any product size, in any sequence. Each model color is readily available to the painters ...and with efficient overspray removal provided by the spray booth exhaust system, several colors can be sprayed simultaneously without fear of drift. Air entering the spray booth is filtered and the volume is greater than the air exhausted. This keeps the painting area completely free of dust and improves finishing quality. Health and housekeeping standards are also high.

Free planning service

During the past 65 years, Binks has designed and installed finishing equipment for thousands of companies, painting and coating countless products. This experience plus a complete line of finishing equipment is available for application to your needs. It doesn't cost a penny to talk to a Binks engineer...it may save you thousands of dollars.

Ask about our spray painting school
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Forming

J. E. HAWKING
Sales Manager
Pines Engineering Co. Inc.
Aurora, Ill.

bar stock. Electroshaping will mill, drill, saw, trepan, contour turn, and do practically any other standard metalworking operation. Potentially, Electroshaping should handle any new alloy—hardness is of little consequence.

Intricate, high strength, forged components with an accuracy and finish meeting commercial specifications will be made possible by Electroshaping. Because it is suitable for speedy diemaking, the method eventually should lower forging costs and speed the output of new designs.

Automatic Handling, Dialing To Aid Tube Fabricators

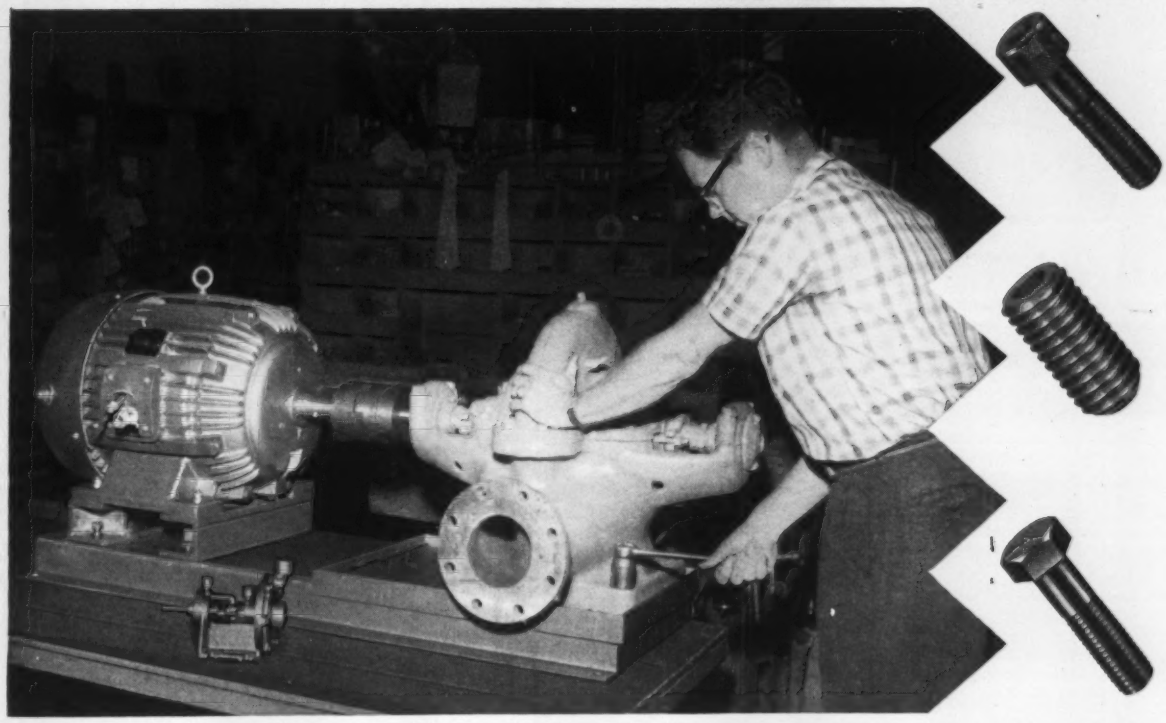
J. E. Hawking—Markets for steel tubing, roll formed shapes, and extrusions are widening. Result: Fabrication methods and equipment are becoming more complex and more competitive. Fringe operations like end finishing (deburring, chamfering, and end facing) demand more consideration and treatment than they formerly received. In 1961, we will announce a standardized line which will perform those operations automatically.

Automatic material handling, forming and bending of tubing, pipe, and shapes will be practical this year only on a high production basis. Tape and numerical control systems are not yet practical.

The coming year will definitely see electronic dialing of some machine adjustments now made by trial and error on interchangeable mechanical stops. Such controls will "leapfrog" some tape development programs.

This year, we will also see the employment of high speed bending presses for high pressure steam boiler tubes up to 3 in. in diameter with wall thicknesses up to 0.20 in.

IT PAYS TO STANDARDIZE ON **STANSCREW**



Stanscrew service, complete selection save trouble, money for Deming Pumps

The Deming Company of Salem, Ohio has stringent requirements for fasteners. They must be of the highest quality to maintain Deming's outstanding reputation for dependability and low maintenance. And, since Deming produces the world's broadest selection of pumps for home, farm, municipalities and industry, they need a fastener supplier with a complete selection to meet a wide range of applications.

Using Stanscrew products and services, Deming fills these demanding requirements and receives many bonus benefits. For example, the Stanscrew fastener specialist and their Stanscrew distributor have provided technical assistance and stocking suggestions which have allowed Deming to reduce inventory in several instances, for significant savings.

Industrial leaders in every phase of industry are learning the wisdom of specifying Stanscrew for fasteners. A complete selection of over 5500 different types and sizes provides dependable, economical answers to the overwhelming majority of industrial requirements. Stanscrew's complete stocks at three convenient plants provide insurance against delivery interruptions. And, a really fast delivery policy avoids costly production interruptions in emergencies.

Call your local Stanscrew distributor today. He will be happy to arrange a prompt visit from the Stanscrew fastener specialist. Often his suggestions on assembly procedures, inventory adjustments or fastening techniques can cut your costs.

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TECHNICAL PROGRESS

Cleaning and Finishing

Experts predict progress in cleaning, finishing, and plating will pay off in longer service life, better appearance for metal parts

Improvement Forecast in Plating Automotive Trim

M. B. Diggin—More attention will be focused on increasing the corrosion protective qualities of nickel-chrome automotive finishes. The job can be done by improving deposit distribution and by paying more attention to quality control.

Automotive trim of intricate shape makes the production of uniform deposits difficult. In recesses, the required protective value is often insufficient without overplating the exposed high current density areas. Auxiliary anodes increase plating current in the recessed areas, and electrically inert shields shade projections.

Recent developments have favored the use of carbon for anodes. Newer forms of carbon are more stable.

Older types of semibright and bright nickel baths will not tolerate a high insoluble auxiliary anode area because of oxidation of the organic addition agents present. Newer types are not degraded by the use of insoluble anodes. With the new techniques, automotive trim can be expected to be of increased durability.

Electrochemical Processes Form, Protect Metal

C. L. Faust—Improved metal finishing is to be expected because of two trends: Improved techniques for protective coating with electroplates and electrolytic stock removal in place of mechanical methods.

Plated parts having multilayer coatings will have a better appearance and longer life. Examples are duplex nickel overlaid with crackfree chromium; such plates in chromium-nickel-chromium combination; and duplex nickel overlaid with microcracked chromium. Alloy coatings formed by plating layers of metals and alloying by diffusion heat treatment have unique, untapped prospects for protection against corrosion and oxidation.

Accurate removal of stock by electrolysis was recently announced. The surface has the true structure of the basis material, free from stress and disturbed fragmented metal. This essentially directed electropolishing process is both the roughing and finishing operation.

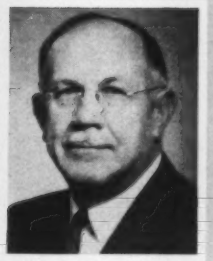
Mechanical, design, and production engineers will profit by becoming familiar with benefits to be gained by electrolytic processes. Conversely, electrochemical engineers can contribute via awareness of needs for metal shaping as well as for finishing.

Complex Plating Cycles Make 'Standard' Ones Archaic

J. V. Davis—Prospects for electroplating equipment are showing increasing interest in the numerous applications and advantages of new plating processes, as well as efficient use of older ones.

A variety of savings can be realized through the use of advanced, modern processing cycles, even though three to ten additional tanks may be involved.

Major cost savings at locations where rinse water must be specially treated prior to being released into sewers is, by itself, sufficient justification for equipment that has a greater initial cost. Modern cycling, utilizing double or triple counterflow rinses, wetting agents, special purpose cleaners, power sprays



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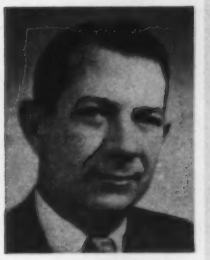

T. J. KEARNEY
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H. C. IRVIN
President
Allied Research Products Inc.
Baltimore

timed to operate only during transfers, more accurate control of temperature, and many others are under close scrutiny by cost conscious plating engineers.

"Standard" plating cycles and processes are archaic. Modern advances in the plating industry impel the individual plater to seek out equipment and processes best suited to his needs.

Better Chrome Plate Will Brighten Autos

H. D. McLeese—The automobile industry, in particular, is finding that thicker chromium plating will give exterior decorative trim necessary brightness and increased corrosion resistance.

For nearly 30 years, chromium deposits of about 10 to 20 millionths of an inch have been standard. Greater thicknesses meant excessive cracking. About five years ago, heavier, dull, crackfree deposits of chromium for industrial applications were produced; subsequently, ways have been found to plate bright, crackfree chromium in thicknesses of 30 to 100 millionths of an inch.

Even greater corrosion protection can be obtained by combining an initial deposit of bright, crackfree chromium with a controlled deposit using a plating solution developed originally for plating chromium directly on stainless steel. It will be used on many 1961 cars.

Another development which has only recently become available is a self-regulating, high speed chromium plating compound with built-in suppressant to minimize chromic acid spray.

Better Appearance, Longer Life Result from New Ideas

W. A. Wesley—For the first time since the prewar years, we find manufacturers daring to call the attention of the consumer to the good quality and permanence of the plated finish they will offer. That is possible because of: 1. An increase in total thickness of coatings specified. 2. The success of the multiple layer, nickel-chromium finish.

New processes for "electroless plating" will be available in 1961. In addition to a well-established process for nickel deposition, offerings will include electroless copper, palladium, and cobalt, as well as new immersion or displacement coatings of platinum and gold. Electroless processes for depositing chromium, iron, and alloys of vanadium may not get out of the laboratory stage in 1961.

Another new development is the deposition of nickel coatings containing finely dispersed particles of abrasive materials, which endow the coating with remarkable resistance to wear.

Improved processes for plating on aluminum alloys can be expected.

Finally, the metalworking manager can look for new applications of plating for the prevention of stress corrosion cracking.

New Methods Offer Finishing Versatility

W. P. Innes—The use of electropolishing processes has expanded. New processes and improved techniques have resulted in lower cost, higher quality, and improved corrosion resistance. Both ferrous and nonferrous metals are now electropolished directly.

It is now possible to strip nickel from brass; copper plated, zinc base diecastings; and steel. That means plating rejects can be salvaged economically.

Electroless nickel deposits can be safely stripped from any conventional basis metal regardless of the phosphorus content of the nickel deposit.

For the first time, a process is offered for blackening electrodeposited nickel. Work formerly plated in black nickel baths can now be blackened after plating.

A new colorless conversion coating for copper and brass prevents tarnishing and preserves excellent solderability.

Immersion tin coatings are being used in many different industries for solderability, decoration, and corrosion resistance.

New metal cleaning processes for smut removal on steel give economical operation, higher final luster, and freedom from speckle, roughness, and pitting.

Recovery Systems Will Cut Maintenance Costs

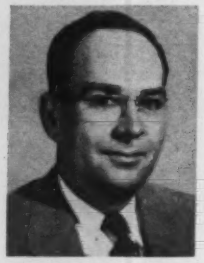
T. J. Kearney—Continuous efforts are being made by the suppliers of industrial metal cleaning equipment to reduce total cleaning costs. One of the most rewarding areas is in the reduction of maintenance costs. Full automatic filtration systems, continuous stills, and solvent recovery units will substantially reduce degreasing maintenance costs.

Look at Whole Picture For Efficient Cleaning

H. C. Irvin—Success in obtaining an answer to a metal finishing problem depends, first, upon knowing the performance requirements with regard to the finish in question and then the conditions under which it will, or can, be applied.

The steps in processing are interdependent and the effectiveness of each step is influenced by the method of accomplishment. Seemingly small factors such as the time element involved in transferring parts being processed from one

Cleaning and Finishing



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GORDON RICE
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operation to the next can have a decided influence on the end result.

We feel that costs are of primary importance, but that savings in costs which provide a finish of questionable value is false economy.

Greater emphasis must be placed on the control of related steps in complete processing, based on the concept that old things can be made to do a new job, or better job.

CLEANING PROCESSES

Liquid Cleaning Compounds Will Simplify Operations

M. F. Maher Jr.—Increased automation in metalworking will increase the demand for liquid cleaning compounds. Research in surface active chemicals has produced liquid materials with all the detergent properties of powdered compounds. Liquids can be metered into solution to give constantly accurate control of solution strength and pH. Also, liquids can be pumped directly from drums at predetermined rates—there is no need to stop for additions or premix stock solutions.

Improvements will continue to be made in phosphate and chromate conversion coatings. We believe that the new compounds will give better protection against corrosion while they permit a wider variation in application techniques.

Those compounds and techniques will be increasingly important in the rapidly developing practice of prefinishing metal in strip form before fabrication. Such processing will demand greater consistency and more precise control.

Improved Cleaners Reduce Inventory

A. E. Carpenter—The cleaning of metals prior to their final finish has been unduly complicated in recent years. Light duty, medium, and heavy duty cleaners have been introduced for each type of metal and for every soil.

What seemed to be needed were fewer cleaners which, strangely enough, should be milder rather than more severe from a chemical standpoint, but with increased *detergent* power.

Mechanical agitation has been given extra attention. Soak tanks are being given agitation. Rotary type equipment is increasing in use. Pump pressures are higher, to help release soil faster. So milder cleaner with high detergency will do a good job, but it is important to control foam characteristics.

Building a rust preventive into the cleaning compound is practical and helpful in production line work.

There are applications where a strong cleaner is needed; for example, to remove resin finishes. Here powerful solvent action can replace high caustic types.

Progress in Finishing For Light Metals Cited

E. J. Kubis—The big developments in metal finishing chemicals this year will be in the field of light metals.

New cleaners will be available for removing buffing compounds from aluminum without metal attack. Cleaning before bright dipping will be simplified and improved.

Plating on aluminum is becoming more popular, and rightly so. Procedures are being simplified, and deposits are more durable. Nickel and chromium plated aluminum appears to be headed toward a bright future.

Magnesium, long handicapped because of its relatively poor corrosion resistance, will be re-evaluated by many because of a promising new stannate film treatment. It is said to be particularly effective in salt laden road splash and marine environments.

Paint removers for light metals have also been improved. Epoxy, acrylic, and vinyl finishes may now be removed from aluminum and magnesium quickly without metal attack with new type strippers based on solvents plus activators.

Good Cleaning Essential For Honeycomb Brazing

Gordon Rice—In the manufacture of supersonic aircraft, stainless steel honeycomb withstands 500 to 700° F.

It is necessary that all stainless honeycombs be 100 per cent perfect in terms of strength and thermoconductivity.

A cleaning process which will be applied gives the desired node flow in the honeycomb structures and enables manufacturers to produce a uniform product. Steps involved include: Degreasing, alkaline cleaning with a mild cleaner, alkaline degreasing with a strong alkaline chelating compound, scale conditioning with a strongly alkaline and highly oxidizing solution, and finally a mild descaler.

Use of ultrasonics in connection with

Cleaning and Finishing

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Executive Vice President
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Detroit

LOUIS McDONALD
Vice President & Technical Director
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Los Angeles

those steps aids further in obtaining the desired quality.

PROTECTIVE FINISHES

Protection Is Simplified By Single Step Coating

E. S. Garverich—A new, single step coating offers a major contribution to faster and more economical metal finishing in 1961. The process is a type of chromate surface treatment that provides exceptional resistance to most acids, alkalies, solvents, and oxidizing agents. It can be applied in a single step to all types of metals, from mild steel and aluminum through stainless steel, galvanized steel, copper, brass, and other metals.

Coatings are applied in aqueous solution at room temperatures by roller, dip, or spray. Required contact time is only a few seconds. The solution has a low viscosity, covers surfaces quickly, and drips free readily from dipped pieces. Curing temperatures range from 350 to 425° F and curing times are short. The coatings provide the user a range of choices of appearance, film weight, corrosion protection, and formability.

Trichlorethylene Systems Paint and Phosphatize

M. E. Baker—Nineteen-sixty was a year of progress for the new concept of complete metal finishing based entirely on trichlorethylene. Combinations of three operations—vapor degreasing, anhydrous phosphatizing, and nonflammable painting—were incorporated into new equipment installations. Nineteen-sixty-one should see further expansion in this field.

Although vapor degreasing with trichlorethylene is a familiar metal cleaning procedure, its extension to phosphatizing and painting has opened a whole new field. The two step, degreasing-phosphatizing process produces parts dry and ready for immediate painting.

After phosphatizing, the use of the new trichlorethylene-thinned painting process eliminates flammable thinners while further reducing operating costs. The application methods, either dip or spray-in-vapor, are efficient in paint utlization and recover the trichlorethylene. Continuing research work by paint manufacturers has increased the selection of colors and resin types. This, in turn, has widened applications.

Continuous Phosphate Lines Protect Quality of Finish

M. B. Roosa—The automobile industry is turning to hot dip galvanized steel as a material for certain critical uses. The shift called for the development of a phosphate coating treatment which would provide a satisfactory substrate for organic finishes. Look for increased utilization of such treatments.

The past year saw a tremendous surge in the production capacity of continuous, strip finished aluminum and steel, with production speeds up to 150 ft per minute.

These developments will increase strip finished production appreciably by the addition of another important metal surface—hot dip galvanized steel.

These products will supply the phosphate coating industry with one of its most important sales growth opportunities this year.

Another area of good growth in 1961 is the application of vinyl laminate to chemically treated metal in continuous strip.

Acrylic finishes, the "magic name" in the organic finishing field in 1960, will see much wider use this year. The characteristics of this "hard" type of organic finish call for iron phosphate and microcrystalline, zinc phosphate coatings.

In-Place Preparation For Painting Predicted

Louis McDonald—In 1961, metalworking, particularly the heavy equipment industry, will utilize new paint preparation procedures for items of equipment too large or massive or too few in number to justify conventional immersion or spray washer methods.

Manual methods which include wire brushing and solvent-acid wiping will be replaced. This is made possible by rust removing, cleaning, and phosphatizing products applied by a unitized, manually operated, and automatically controlled combination cleaning and phosphatizing machine. The machines discharge cleaner-phosphatizing solutions at high pressures and temperatures.

The key factor in the success of the new method of finishing resides in the chemical, physical, and performance prop-

Cleaning and Finishing

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D. S. **GAARDER**
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J. F. **WHITCOMB**, General Manager
Coated Abrasive & Related Products Div.
Minnesota Mining & Mfg. Co.
St. Paul

erties of the cleaning-phosphatizing compositions. The products clean and phosphatize almost simultaneously.

Final rinsing with chromic acid or similar toxic and hazardous rinse compositions, or even with water, is not required to provide a surface properly prepared for a durable organic finish.

Prefabrication Calls for Prefinishing of Metals

J. O. J. Shellenberger—In the coming years, it seems to us that we are going to find a greater than ever demand for painted, prefabricated metal. This trend will get its impetus partly from high labor costs, but possibly even more important is the desire for color. Specially adapted pretreatments promote adhesion between the metal and the finish, help the metal resist corrosion. The product will require special organic finishes so that it can be formed, bent, pressed, or otherwise shaped. Corrosion resistance will be a tremendous factor.

We look also to an increased amount of prefabrication. That too will involve pretreatment and finishing problems. As with strip, we believe the final finish will be a special organic but still it will be what we commonly describe under the generic heading of "paint." There are a number of methods of coloring the metal directly but except in specialties, we think the paint type finishes are more flexible in application, have better ranges of color, and are more economical as a rule.

Resin Coatings Improved Metal Sales Appeal

A. D. Duncan—Ten per cent of the Fabulous Sixties is now behind us, and as expected, growth is not automatic. It does not come just because it is predicted; it must be earned.

Water reducible coatings (free from organic flammable solvents) will make further progress as primer shopcoats and as one coat and two coat systems for metals and nonmetallic products, such as fiber, cardboard, and paperboard drums, boxes, or parts.

The use of precoated metal as coils will increase, permitting faster, lower cost, more efficient material and labor utilization—particularly for high volume items.

The exotic synthetic resins and plastics, such as polyester, acrylic, vinyl, butadiene, styrene and other copolymers, terpolymer or quaternary polymer resins, will find increased use on products requiring greater resistance to varied exposures.

Paint and plastic coatings for metal will play an increasingly important role in helping the metalworking industry hold its old markets and capture some new ones.

Look for Trend Toward Tailormade Metal Coatings

D. S. Gaarder—Heavier films, more careful selection of coatings, and increasing use of high speed strip coating techniques are the most likely trends in the metal finishing field.

The heavier films will probably be achieved through the use of plastisols and organosols, rather than through the use of multiple coats of more conventional finishes. They eliminate much of the cost of solvents—all of which are eventually lost through evaporation.

Heavier coatings have other inherent advantages: Greater flexibility in the control of film thickness and interesting design possibilities.

The philosophy of coating selection has undergone significant changes in recent years. Coatings are formulated in terms of specific needs. Partisan preference for one resin over another, for example, must increasingly give way to a more individualized approach.

Precoating of metals before forming has been a prominent development. Wider use appears inevitable.

ABRASIVE PROGRESS

Power Programing Trims Abrasive Finishing Costs

J. F. Whitcomb—Power programing, a method of greatly decreasing abrasive belt costs and improving the grinding and finishing of steel and titanium, will be one of the major developments in the coated abrasive field in 1961. A constant rate of cut is maintained by compensating for the normal wear of the abrasive through a schedule of power increase.

With this method, first announced late in 1960, not only is more efficient use made of the abrasive belt, but more uniform stock removal and surface finishes are obtained. In addition, more of the available horsepower of the grinding machine is used.

In 1961, we also expect a brush made of a nonwoven, nylon material infused with an abrasive to be in widespread use in cleaning lines in the primary metal industry. It will be applied in the major appliance field, as well as in the automotive industry.

Another major development we expect

WEATHER
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T-J
TOMKINS-JOHNSON TRIBUNE

★★★★★
FINAL

THE TOMKINS-JOHNSON CO. • 2425 W. Michigan Ave. • Jackson, Michigan

INCREASED PRODUCTION... CREATES PRICE ADJUSTMENT

on T-J Squair Head Cylinders

JACKSON, MICH. JAN. 3 (TP)—"Due to the tremendous initial response and the continuing acceptance and purchase of the new Tomkins-Johnson Squair Head Cylinders, it has been possible to *lower* the basic price," according to T-J personnel. In effecting this price cut, Tomkins-Johnson has again proven that acceptance of a quality product and the inevitable increase in manufacturing volume *CAN* economically justify a price reduction *WITHOUT* jeopardizing quality.

The T-J Squair Head Cylinder, an interchangeable air cylinder for any pneumatic power application, was first introduced by Tomkins-Johnson in 1958. It was an immediate success because of its availability in a wide range of bore sizes and strokes . . . as well as the standard quality features, including the new T-J Super-Cushion for air cylinders.

Other Standard Features

Other standard T-J features that allow the T-J Squair Head Cylinder to retain its high quality comparison over other makes of air cylinders and still give you lower price are; solid steel heads and mounting plates, hard-chrome plated bodies and piston rods, leak-proof cylinder head to body construction, heavy duty, high tensile ground and polished chrome, plated piston rod, and many more . . . STANDARD AT NO EXTRA COST.

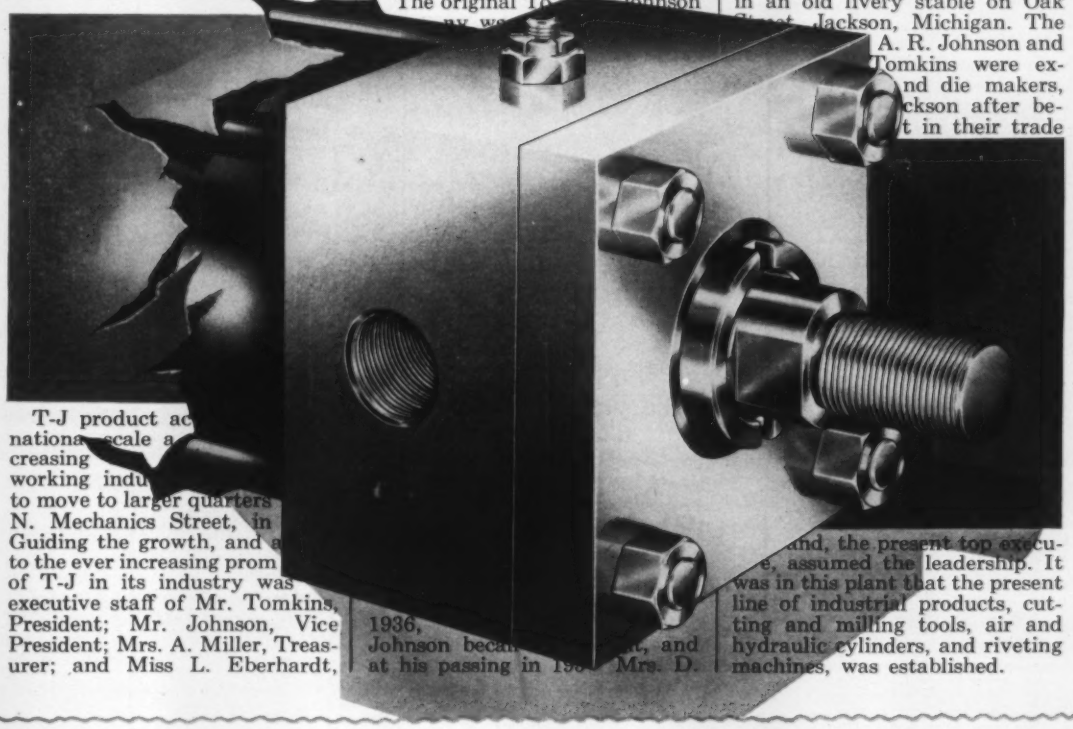
Tomkins-Johnson, by virtue of the announced lower cost on its Squair Head Cylinder, wish to thank their customers for their initial acceptance which has been such a contributing factor in this price reduction.

T-J Produces Complete Line

Tomkins-Johnson also produces a complete line of hydraulic and pneumatic cylinders for *EVERY* power drive application . . . including the very popular Spacemaker. If you need further information or complete catalog material, write T-J direct, or request it from your T-J sales representative.

The Tomkins-Johnson Company was founded in 1917

The original To[illegible] Johnson [illegible] in an old livery stable on Oak [illegible] Jackson, Michigan. The [illegible] A. R. Johnson and [illegible] Tomkins were ex[illegible]nd die makers, [illegible]ckson after be[illegible]t in their trade



T-J product ac[illegible] nationa[illegible] scale a[illegible] creasing [illegible] working indu[illegible] to move to larger quarters [illegible] N. Mechanics Street, in [illegible] Guiding the growth, and a[illegible] to the ever increasing prom[illegible] of T-J in its industry was [illegible] executive staff of Mr. Tomkins, President; Mr. Johnson, Vice President; Mrs. A. Miller, Treasurer; and Miss L. Eberhardt,

1936, [illegible] Johnson becam[illegible]t, and at his passing in 19[illegible] Mrs. D.

[illegible]nd, the present top execu[illegible]e, assumed the leadership. It was in this plant that the present line of industrial products, cutting and milling tools, air and hydraulic cylinders, and riveting machines, was established.

Cleaning and Finishing

W. L. KENAGY
Vice President
Simonds Abrasive Co.
Philadelphia

R. C. TROW
Vice President & General Manager
Almco Queen Products Div.
King-Seeley Corp., Albert Lea, Minn.

J. P. GAETH
Vice President & Treasurer
Osborn Mfg. Co.
Cleveland

J. A. PEARSON
President
Alloy Metal Abrasive Co.
Ann Arbor, Mich.

C. R. CLINE
Assistant to the President
Wheelabrator Corp.
Mishawaka, Ind.

to see in use in the coming year is the grinding of hot metal with abrasive belts.

Look for an Increase in Grinding Wheel Speeds

W. L. Kenagy—Significant developments in abrasives for 1961 indicate continuation of the trend towards faster operating speeds of grinding machines with resultant increases in production efficiency. Success is dependent upon the technical improvements of grinding wheel bonds and manufacturing processes which make these higher speeds safe under special circumstances of use.

Grinding wheels will continue to grow in importance, processing many of the extremely hard metals and materials, such as the so-called exotic or Space Age materials coming to the fore. Great progress is also being made in the degree of finish.

The market for grinding wheels during 1961 should follow the general level of industrial metalworking activity.

Good Surfaces Formed By Vibratory Machinery

R. C. Trow—Vibratory machines will answer the demands of U. S. industry for newer, better, faster finishing.

The vibratory method, it is claimed, delivers high standards of deburring, descaling, radius forming, burnishing, cleaning, and general surface refinement of metal parts up to 100 times faster than conventional finishing. Such speed is possible even while maintaining extremely close tolerances.

The new concepts in speed, efficiency, and uniformity are due to the unique vibratory motion. As the entire mass within the tub rotates, a scrubbing action is generated on parts by the media.

Vibratory machines yield fast cutdown, or a slower, more gentle vibratory action that produces a high degree of precision work.

Wire Brushing Saves In Finishing Metals

J. P. Gaeth—Power driven, wire wheel brushes that can do more work have been developed.

Newly developed metal removal characteristics have broadened the scope of wire brush applications, particularly in the nonferrous industries. Operations such as cleaning and preparing slabs prior to cold reduction appear to be well within the scope of these brushes, with substantial savings in base metal. They will be also used to remove the flash from molded rubber, plastic, and diecast parts.

In the manufacture of gears used in automotive transmissions, power driven brushes are moving from secondary cleaning operations into primary finishing operations. In conjunction with semiautomatic or automatic machinery, power brushing follows the hobbing operation, deburring and blending the edges of the gear teeth prior to shaving.

The use of the improved wire wheels in the basic steel industry to improve surface finishes by removing carbon smut and other surface adherents after blasting or pickling looks extremely promising.

Proper Abrasive Choice Drops Cleaning Costs

J. A. Pearson—Metal cleaning is improving with better metallic abrasives.

Much attention has been paid to low cost cleaning but there should be understanding also that improved surface can be obtained with proper size, hardness and type of abrasive. That may increase the cleaning cost but improved surface results can reduce other costs.

There seems to us little doubt that blast cleaning equipment will be developed which will have improved functions and flexible handling of abrasives. Equipment will be made which can use the higher quality of steel shot more efficiently.

Shot peening is also gaining in importance. Cast steel shot has aided in this development and much has been learned about the performance of peened parts.

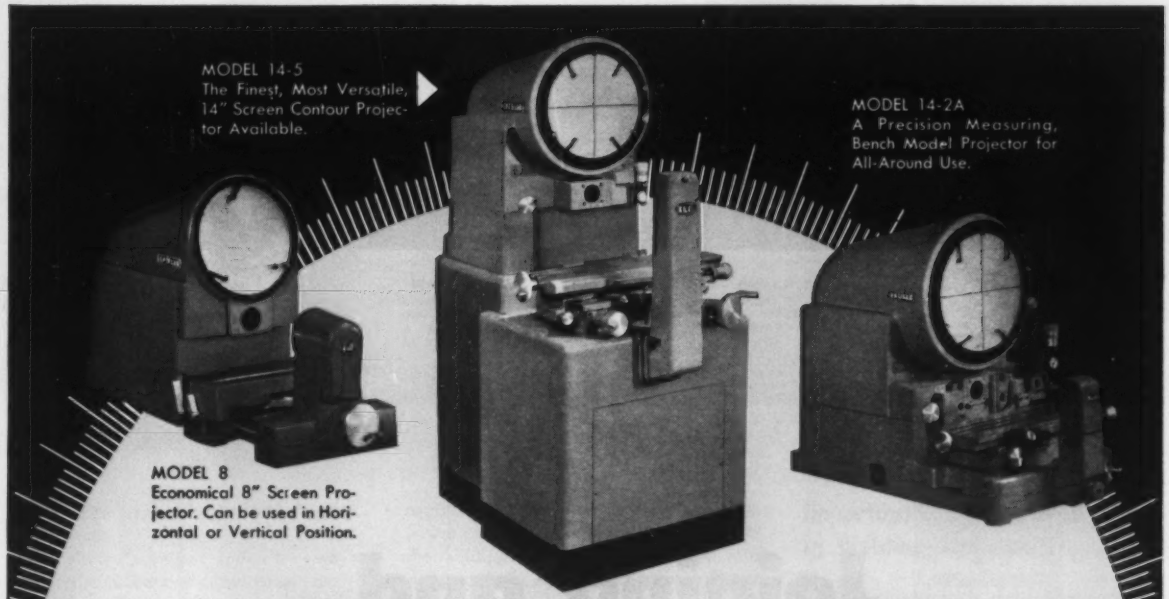
Blast Cleaning Assists Inspection, Protection

C. R. Cline—With some state highway commissions now requiring the use of scalefree structurals in bridge construction, mechanical cleaning as a key production tool is certain to gain momentum.

Furthermore, all Canadian government contracts for bridges and buildings include "cleaning to white metal" or "mechanical cleaning prior to painting" in their specifications. That is also true for virtually all steel construction in the power transmission field. In addition, scalefree structural steel has been mounting rapidly. And in most cases, blasting with steel abrasives is specified.

Surely due for wider acceptance is the descaling of slabs and billets prior to inspection. This process makes visible surface defects that would otherwise go undetected.

The year ahead should also witness greater utilization of automated wire and bar drawing lines incorporating blast descaling operations.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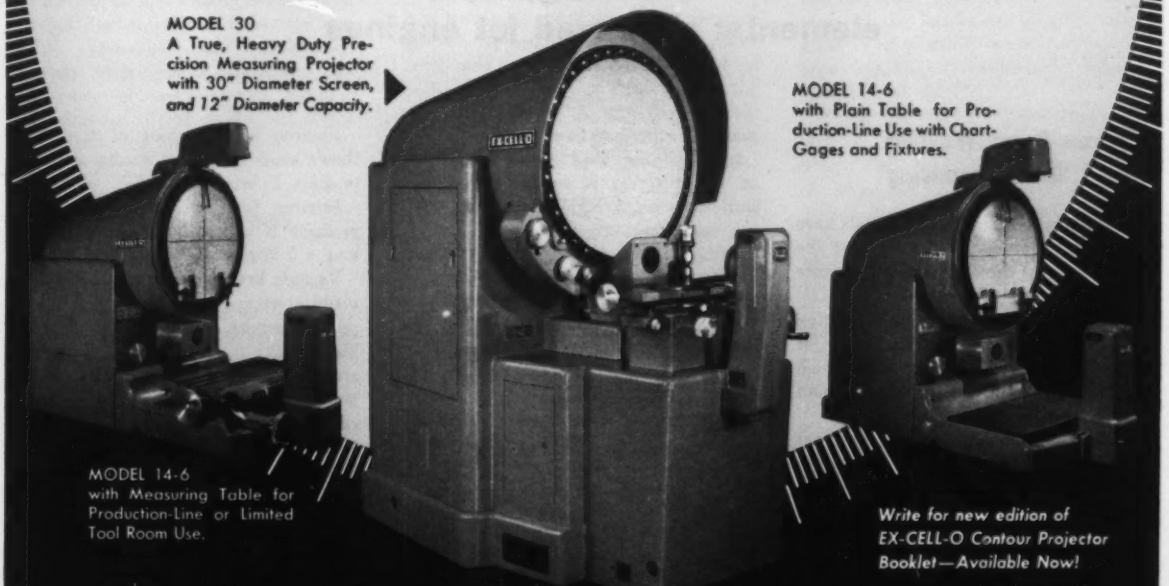
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A. O. Smith Corp.
Milwaukee

R. A. WILSON
Vice President & Director
Application Engineering,
Lincoln Electric Co.
Cleveland

TECHNICAL PROGRESS

Joining and Assembly

Here's what's ahead: Electrogas, a new process for vertical welding; ultrasonic welding of fuel elements; all-brazed jet engines

Electron Beam Welding Called 'Most Promising'

David Sciaky—The refractory metals have been called on to meet the needs of the Space Age. Lack of fabricating experience has generated much research.

By far the most promising fabricating technique is electron beam welding. A type of fusion welding, it employs a high velocity beam of electrons in a vacuum to produce ultrapure welds.

We see the vacuum of outer space as a logical site for assembling stations or vehicles for extended flight: The usual problems associated with vacuum chambers would be eliminated and "in the open" welding, drilling, cutting, and machining would be possible.

Resistance Welders Rely Heavily on Automation

T. Embury Jones—Builders of resistance welding equipment are investing heavily in research and development. They are aware that almost any alley shop can make a simple resistance welder. The future for the dedicated builders lies in the direction of new processes and intricately tooled, highly automated welding machines.

We will see more special resistance welders engineered into transfer lines in which stamping, coining, preforming, assembly, welding, and postforming are combined into a single automated unit.

The electrical industry, especially, has taken to the special resistance welder with either the Geneva table or in-line transfer. Such machines will continue to help hold the price line.

We shall also continue to contribute our share of new ideas. For example: Automobile makers are beginning to adopt the foil butt seams process to widen deep drawing steel sheets at low cost.

Electron Beam Welding Reaches Commercial Stage

John J. Chyle—For many years, welding was considered an art. We have finally emerged into a new era of scientific welding.

Electron beam melting of metals has shown some interesting results, and rapid progress is being made.

Electron beam welding of commercial products is underway. Containers 60 ft long x 5 ft are on the drawing board.

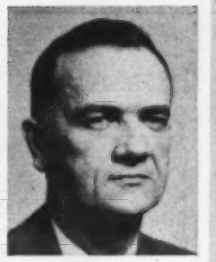
Vacuum brazing holds great promise for many exacting requirements in high temperature service, or for applications where high quality is required. In vacuum, we are able to remove the debris of contaminating adsorbed materials. Theoretically, by obliterating such debris, top quality pressure welds would be possible.

Another area with possibilities: Diffusion bonding. In its early development stage, promising results have already been obtained especially for the reactive and refractory metals, and for dissimilar metal combinations which cannot be joined by fusion welding.

Vapor Shield to Challenge Manual Welding Systems

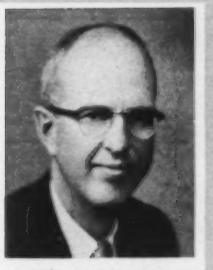
R. A. Wilson—The trend to mechanized arcwelding will increase rapidly in 1961.

J. BYRON JONES
President
Aeroprojects Inc.
West Chester, Pa.



J. F. GALBRAITH
Development Manager
Linde Co., a division of
Union Carbide Corp.
Newark, N. J.

E. S. TWINING JR.
Vice President, Marketing
Air Reduction Sales Co.
A division of Air Reduction Co. Inc.
New York



R. DAVID THOMAS JR.
President
Arcos Corp.
Philadelphia

Reason: The press of foreign and domestic competition.

Today's management looks for major dollar cost reductions from better methods and new processes. Strong interest in new processes and methods which step up material flow and increase performance efficiency will bring investigations of recently introduced full and semi-automatic processes (for example, vapor shielded arcwelding). The coming year will see the advantages and disadvantages of those processes brought into better focus.

Our initial field experience makes us feel that vapor shielding holds the answer to rapid mechanization. It features simplicity, versatility, and compactness. Through refinement of application and development of new electrodes, the process is expected to reduce the cost of arcwelding to a new low.

Ultrasonic Welding Grows, Slated for Foreign Move

J. Byron Jones—Continued basic research in ultrasonic welding—including photoelastic analysis of the associated dynamic stress systems, temperature measurements, and examination of welds by electron microscopy—has disproved nearly every possibility that melting is involved in the process.

Now in production, or pilot production, is equipment for such applications as: Attaching leads to semiconductors; encapsulating semiconductors to rigid helium leak specifications; splicing metal foil during manufacture; fabricating atomic reactor fuel elements. Also, the solid state welding process is receiving serious study by the packaging, refractory metals fabricating, and numerous other industries.

We are seeing increasing enthusiasm for the advantages of joining aluminum without meticulous precleaning; for the convenience of being able to adapt the equipment to automated installations (the power cabinets can be 100 ft away from the welding head); the capacity to join extremely thin or fine materials to heavy objects.

Ultrasonic welding equipment is moving into the international field. U. S. industry will continue to set the pace for its application.

Submerged Arcwelding Tames High Tensile Steel

J. F. Galbraith—Manual welding of carbon steel with continuously fed electrode processes is coming along fast. CO_2, both with sand and without flux, gained in both quality and cost. New tube wires, with and without gas shielding, are becoming more competitive. Use of inert gas shielding with small wires and some CO_2 in the mixture is expanding rapidly as costs come down. We should see a significant amount of covered electrode welding converted to one of these new processes this year.

We had a breakthrough in the submerged arcwelding of high tensile steel. Impact properties are excellent (both as-welded and stress relieved) at all tensile levels. More widespread use is expected this year.

The plasma torch is proving to be a useful new tool. Its application to cutting both straight line and shapes has been extended from the nonferrous metals to stainless steel—and carbon steel is a good possibility. Metal spraying with plasma arcs is well established; weld surfacing results are interesting; and use of the plasma torch as a welding tool is not far away. All metal fabricators should watch for commercial devices in these areas.

An outstanding development in the field of mechanization: A machine that welds aluminum pipe. Progress in this direction should be made this year.

Important Advances Seen In Welding Stainless

E. S. Twining Jr.—Important advances in the welding of stainless steels will be revealed in the near future. Several new developments will eliminate the serious problem of grain structure in the welding of both the precipitation hardening stainless steels and the chrome-iron-silicon steels.

Such steels are recognized as some of the best materials for cryogenic applications, particularly in aircraft and missiles, but they have been difficult to weld because of the breakdown in grain refinement. The postweld grain structure has been considerably weakened, reducing strength and ductility.

Those qualities are extremely important in Mach 3 plus aircraft and missiles. (They must travel in temperatures of minus 320° F.) Modifications of the gas shielded, metal arc process are underway. They will permit greater welding economy for stainless steels. As a result, the construction of the all-welded B-70 may be extended to all aircraft and missiles.

That welding advance can also be applied to other uses: Hospital and dairy equipment, transport equipment for cryogenic fluids, and chemical field tanks.

Automatic Vertical Welding Slated for Wider Role in '61

R. David Thomas Jr.—A dream of welding engineers has become reality. It is no longer necessary to place weld joints in the downhand position to take advantage of automatic, high speed welding. Joints that cannot be positioned readily can now be welded in a single pass with the electroslag process. The single pass feature may dictate the vertical position for heavy plates to eliminate costly down-

Joining and Assembly

RICHARD C. LIPPS
Manager, Welding-Arc Dept.
Welding Div.
Westinghouse Electric Corp.
Buffalo

R. C. SINGLETON
Vice President, Engineering
Gregory Industries Inc.
Lorain, Ohio

E. RUSSELL CROSS
President
Tubular Rivet & Stud Co.
Quincy, Mass.

W. G. WALTERMIRE
Chief Product Engineer
Lamson & Sessions Co.
Cleveland

time for the slag cleaning and machine repositioning of multipass welding.

Electroslag welding is confined to steel thicker than 1½ in. A new process, electrogas, will be publicly displayed for the first time at the AWS Welding Show in April. It will offer the opportunity to weld vertically plates thicker than ⅜ in. Now under field trial for one pass, automatic welding of vertical butt joints in steel storage tanks, the electrogas process promises reliable cost savings to steel plate fabricators in a variety of industries. It will replace much tedious hand welding.

The advent of single pass, vertical welding can conceivably cause a dramatic shift in our concept of positioning. Instead of building positioners to locate weld joints in the downhand position, such devices in the future may be designed to take advantage of vertical welding's high deposition rate and operator factor.

Electroslag and electrogas welding processes have just arrived. Ingenuity will soon put these newest processes to work for our benefit in the battle for world markets.

Experts Needed to Integrate Rapid Welding Advancements

Richard C. Lipps—Welding technology is moving ahead so rapidly that metalworking managers will need experts to take full advantage of the new techniques as they come along. These are some of the more important trends we believe will affect welding during the next few years:

Gas shielded welding will gain in importance faster than other techniques.

Designers are taking advantage of high tensile steels (150,000 psi) to lighten their products. Welding such alloys will require special techniques and new approaches.

The welding industry is tending toward more complex electronic control of arcs. One possibility: A thermocouple mounted in such a way that weld puddle heat can be integrated with electrical conditions in an arc through a small computer.

Small shops will continue to increase their adoption of semiautomatic units. One reason: They can save $2000 per gun per year in welding costs. One problem yet to be solved is how to pay for the continuing technical assistance.

More than 25 per cent of our current billings are for equipment in the idea stage only five years ago.

MECHANICAL FASTENING

Fastening Is Prime Area For Cost Saving Steps

R. C. Singleton—An increasing realization that fasteners and fastening processes offer many possibilities for cutting costs and improving quality in many metalworking areas has resulted in faster development of new fastening techniques. The industry is looking for equipment that will operate faster, be more nearly automatic, cost less to install, and be troublefree in final assemblies.

Studwelders are meeting those needs. Better procedures, techniques, and equipment have greatly extended range and versatility of automatic and semiautomatic studwelding. Studs up to 1¼ in. in diameter are being used in connection with heavy forgings and steel members. Small, pin type studs and threaded fasteners are finding new uses in sheet metal formerly too thin to be endwelded. Improved equipment, new fasteners attached from one side, leakproof construction, and extreme flexibility will increase the penetration of existing unexplored markets.

Automatic Riveters to Combine Multiple Assembly Functions

E. Russell Cross—Through automatic riveting and cold formed products, metalworking managers can expect increased efficiencies and reduced costs.

Many machines being developed incorporate functions other than the simple feeding and clinching of semitubular rivets. Examples: The feeding of washers and rivets simultaneously, eliminating hand operations. A grease injection station on a dial table unit was developed for a Midwest automotive subcontractor.

Continued development in cold heading has reduced customers' costs with lower priced items. Cold formed grain structure has improved engineering values.

Cites Role of Research In Fastener Improvements

W. G. Waltermire—Demands for weight and cost reduction plus increased strength and performance are accelerating a swing to high strength bolting.

Those needs are being satisfied by: 1. Research and knowledge of joint design. 2. Increased strengths of bolting materials. 3. Careful study of bolt and nut design, particularly fillets, thread lengths, thread classes, and types—the object is to reduce stress concentrations, to meet the need for greater accuracy and higher levels of assembly stresses,

(*Please turn to Page 236*)

Treadwell heavy-duty furnace bumper, installed in a large steel plant

SPECIAL FEATURE

of Treadwell heavy duty furnace bumper:

The bumper head swings up for easy access to the roller table. Saves maintenance-time and trouble.

TREADWELL
ENGINEERING COMPANY · EASTON, PA.

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Mills, Vertical Edging
Mill Repeaters
Coilers & Reels
Tables, Mill
Tables, Tilting & Lift
Tables, Transfer
Transfers
Conveyors, Coil
Drives & Pinions
Ejectors, Furnace
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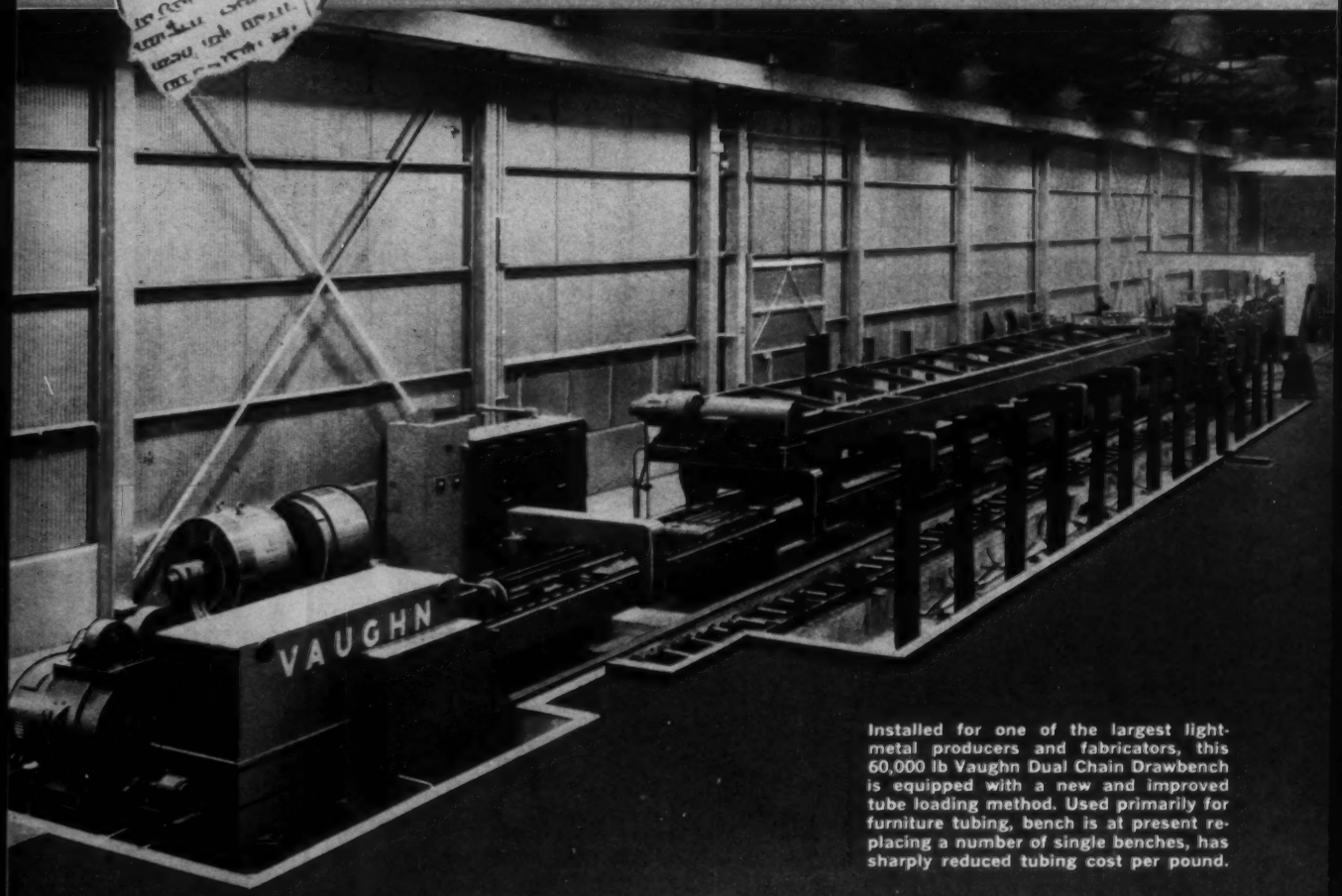
In the NEWS

Vaughn®



Installed for one of the largest light-metal producers and fabricators, this 60,000 lb Vaughn Dual Chain Drawbench is equipped with a new and improved tube loading method. Used primarily for furniture tubing, bench is at present replacing a number of single benches, has sharply reduced tubing cost per pound.

Air-operated carriage and skid arm, equipped with push-off, on Bench shown at left. Carriage has shock absorbers for each bar operating independently.

This Vaughn Bench pulls 60,000 pounds for an Illinois steel and wire producer. Bench points and draws three — 1¼" bars simultaneously.

Drawbenches

NEW DESIGNS HIGHER SPEEDS

Finer Cold Drawn Production!

Vaughn Machinery Company—builders of the world's most complete line of cold drawing equipment—is proud to present advanced new Drawbench models for tubes, bars, and shapes.

Available in double and single chain types, these latest Vaughn Benches employ totally new loading concepts that permit drawing five tubes at a time *and more.*

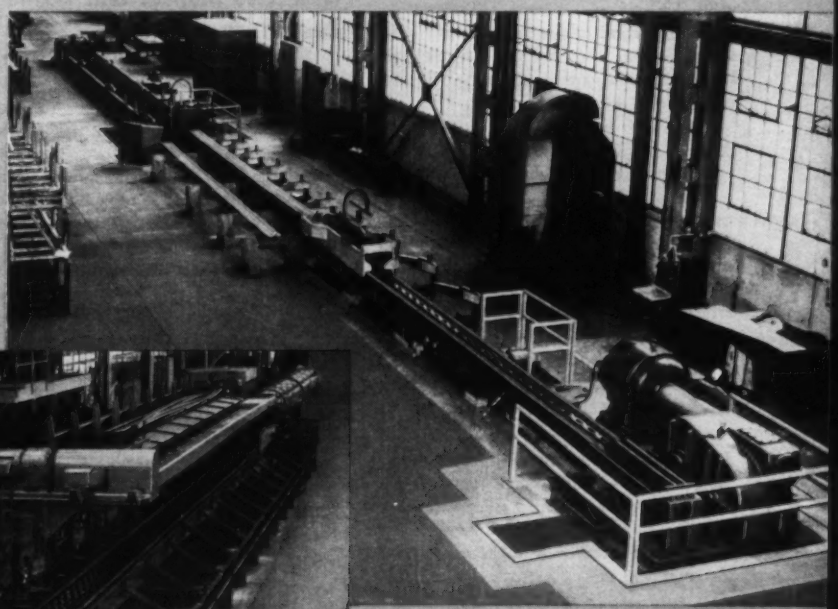
Vaughn dual chain benches now in operation are drawing tubing up to 550 fpm—straighter tubing! In fact, generally higher speeds are now feasible with a new chain design which permits high speeds without lubrication problems.

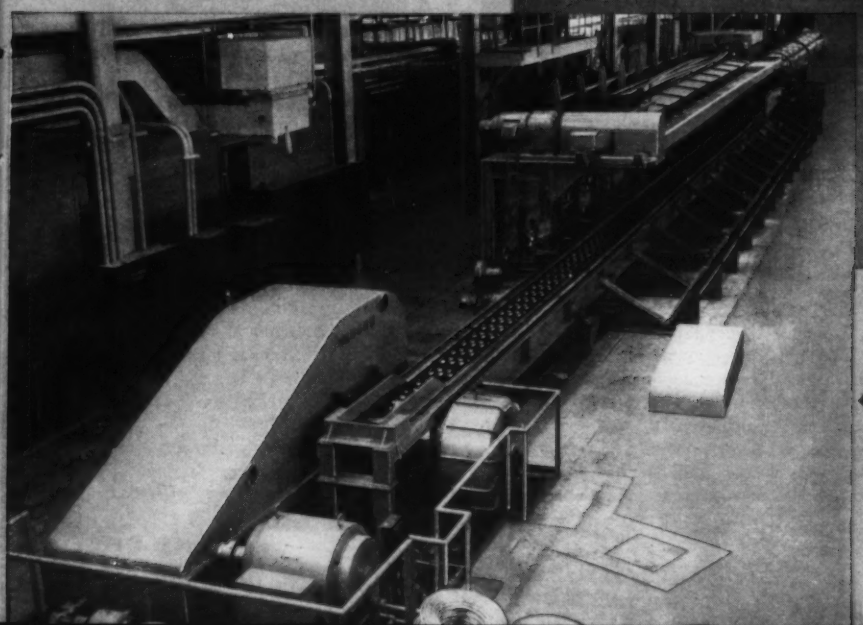
New "floating" foundation design reduces installation and foundation maintenance costs. Many additional refinements contribute to Vaughn leadership in modern drawbench performance. Consult your Vaughn engineer on your cold drawing problems.

The Vaughn Machinery Company, Cuyahoga Falls, Ohio, U.S.A.

If it's Cold Drawn see **Vaughn**

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.





For another Illinois producer, this Vaughn Drawbench is equipped for bars, tubes and shapes. It is used primarily for shaving magnesium on a production basis.

Installed at a large Canadian tubing producer, this Vaughn Drawbench includes roll-over mandrel end, carriage tube shock unit and air clutch. Canada's largest-ever order for copper tubing was recently drawn by this bench.

Joining and Assembly

LAURENCE H. FLORA
Director of Sales
Tinnerman Products Inc.
Cleveland

FRED L. PLUMMER
National Secretary
American Welding Society
New York

W. C. O'LEARY
Technical Director
Adhesives, Coatings & Sealers Div.
Minnesota Mining & Mfg. Co.
St. Paul

R. L. PEASLEE
Vice President
Stainless Processing Div.
Wall Colmonoy Corp.
Detroit

(*Continued from Page 232*)

and to reduce safety factors.

SAE Grade 5 bolts and nuts provide the best strength improvement per dollar. Cost becomes secondary in many applications, and, as a result, the use of alloy steel Grade 8 and higher strength bolting materials will probably increase.

Studies at Case Institute of Technology, Cleveland, confirm the value of nut strip tests. Several combinations of nut and bolt materials are undergoing torque, tension, and load tests.

While the bolting is important, joint design is probably least understood and now offers the greatest possibilities for reducing weight and improving strength. In the last year, the Universities of Illinois and Missouri and Lehigh University have contributed to the knowledge of joint design. Research has been particularly active in Sweden, Russia, and Germany.

Multipurpose Fasteners Gain In Automated Assembly Use

Laurence H. Flora—The engineered, spring steel fastener has become one of the most important factors in mass production. Such fasteners promise new economies on assembly lines in the year ahead. As markets grow increasingly competitive, cost savings will become more critical. Cost-conscious manufacturers will undoubtedly step up design analyses.

Because spring steel can be stamped, twisted, doubled, or bent into virtually any shape, single fasteners made of it can perform many functions. Engineered to include screw, stud, or panel locking features, multiple functioning, spring steel fasteners can shave days off a schedule.

Today's spring steel fastener has built-in automation. The coming year will see a growing number of manufacturers specifying such fasteners.

BRAZING

New AWS Manual Will Boost Industrial Role

Fred L. Plummer—Plans for revision of the Brazing Manual of the American Welding Society emphasize the rapidly expanding use of the method. New sections planned: High temperature assemblies; nonmetallics; honeycomb; pressure vessels; vacuum tubes, transistors and similar elements; and dental assemblies.

Another project; A standard brazing test specimen which will define design strengths sufficiently well to assure engineers that corresponding specific strengths can be consistently reproduced in production. The fact that we do not yet have a standard test or specimen is a measure of its urgency.

A third project: Preparation of standard terms and their definitions, to providing uniform nomenclature.

Future Adhesives to Resist Heat, Cure in Seconds

W. C. O'Leary—Applications of high strength structural adhesives increased steadily last year. They have been used to assemble castings, metal shipping containers, and metal, architectural window frames; and they have been used to bond and seal fuel tanks on advanced aircraft. Today's structural adhesives are strong enough for structural applications exposed to temperatures of 350° F.

New adhesives are being sought for high strength joining at extreme temperatures (for missile applications); good performance and high strength bonds between unclean and oily surfaces; and formulations that require simple application techniques and only a few seconds curing with high heat.

Jets, Rockets Pace Growth of Brazing Applications

R. L. Peaslee—Brazing promises to make rapid advances in the next few years. Biggest gains can be looked for in aircraft and missiles. One jet engine under development is expected to be put together largely with brazing techniques. By comparison, current usage in jet engines is generally about 1 per cent.

Another indicator: Nearly all rockets being produced have tubular engines fabricated entirely by brazing. That trend should continue.

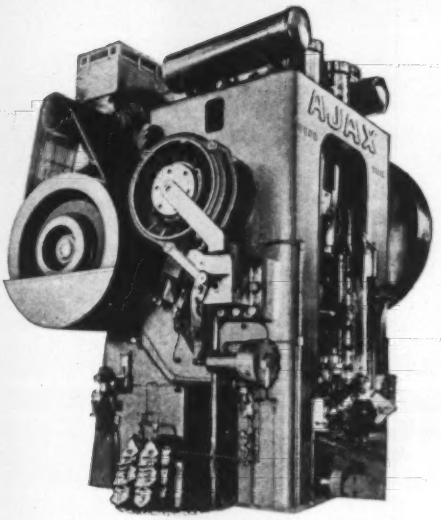
Two company developments parallel that growth. Ten years ago, we had one plant. Today we have four, and we are in the process of planning a fifth.

We can look for expanded brazing applications in aircraft electronics. To date, applications have been limited to cabinets, metal and ceramic seals, industrial tubes, and similar components.

Makers of vacuum leak detection equipment have also begun to recognize brazing's advantages. Vacuum diffusion pumps, stainless steel valves, cold traps, and other leakproof subassemblies are being produced via brazing.

Education continues as the major hurdle to rapid progress in brazing. Design people must be properly oriented.

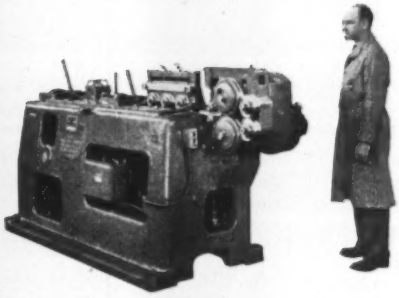
the Ajax line
OF METAL WORKING MACHINES



"HIGH SPEED" FORGING PRESSES

Built in 13 sizes from 300 to 8000 tons capacity. Ajax Presses are built with massive, solid, mill housing-type steel frames. Rigid frames assure excellent alignment and accurate die match for the production of uniform and accurate forged parts.

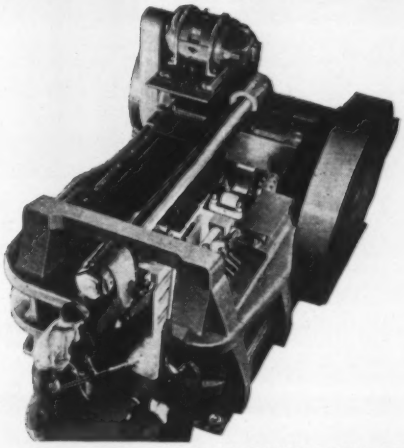
Write for Bulletin 75-C



AJAX-HOGUE WIRE DRAWERS

An attachment for any size cold header and parts former. It cold draws wire in a straight line from hot-rolled stock instead of cold-drawn wire. You save the difference in cost of material and at the same time produce the highest quality cold-headed parts.

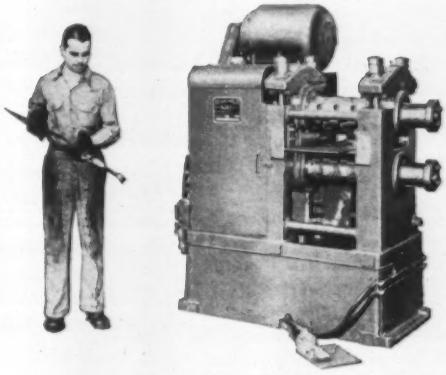
Write for Bulletin 111-B



"AIR CLUTCH" FORGING MACHINES

Choose from a complete line of forging machines—Sizes 1" to 12" to make the forged parts you need . . . Transmission gears —Flanged axle shafts—Crankshaft flanges—Jet Blade Blanks—Implement & Tractor forgings. There's an Ajax Forging Machine for every field of upset forging in industry.

Write for Bulletin 65-D



"WIDE ADJUSTMENT" FORGING ROLLS

Pre-roll your forging blanks for metal saving—longer die life—and better fibre flow. Ajax Rolls are available in 7 sizes to pre-roll forging blanks ranging from connecting rod blanks to the largest propellers. Extension shafts with overhanging dies permit rolling long work.

Write for Bulletin 91-B

SERVING THE FORGING INDUSTRY SINCE 1875

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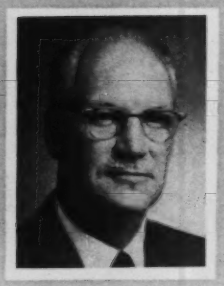

GORDON PATTERSON
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Yale & Towne Mfg. Co.
New York

EUGENE CALDWELL
General Manager, Baker Industrial Trucks Div.
Otis Elevator Co.
Cleveland

EDWARD W. McCAUL
Vice President-Sales
Jervis B. Webb Co.
Detroit

L. WEST SHEA
Managing Director, Material Handling Institute Inc.
Executive Secretary, Industrial Truck Assn.
Pittsburgh

TECHNICAL PROGRESS

Handling and Packaging

Modern machines and application knowhow expected to improve competitive position of U. S. metalworking companies

Better Handling Equipment To Increase Profit Margins

Gordon Patterson—The material handling equipment industry is expected to continue its prominent part in helping business executives improve profit margins, by supplying new equipment and handling methods—designed to reduce the unit cost of manufacturing, packaging, warehousing, shipping, or receiving raw materials and finished products.

The primary aim of most businesses in 1961 will probably be to lower operating costs rather than to increase their production volume. Example: Several steel companies have announced plans to purchase improved equipment that will increase operating efficiency.

After studying needs of many users of material handling equipment intensively, our engineers have developed industrial lift trucks that make more efficient use of cubic space in warehouses, factories, and transportation units. They stack loads higher, faster, and in narrower aisles, and they operate with more flexibility and safety. They are more compact and versatile, but they are designed as "standard" lift trucks, so the user can benefit from the lower costs of volume produced equipment. The new trucks are also designed for lower maintenance expense and longer, troublefree operation.

Why Not Teach the Customer Material Handling Methods?

Eugene Caldwell—It has been said that interest exists only in the presence of conscious want, and we must educate more companies in material handling. They must think of material handling as a relationship of principles and methods that affect their survival potential.

One reason why many manufacturers of material handling equipment (and their marketing people) fail to arouse the enthusiasm of top management is their own lack of awareness of the main objectives of material handling management. We must dig deep and expose the basic problems of survival and growth of an enterprise. We must consider the broad awareness of principles and methods that can help a firm get greater productivity from its capital.

Technological advances in equipment design have far outstripped application. The responsibility for education of equipment users rests with the manufacturers who control most of the market; it is their job to instruct and lead the material handling specialist in industry. He is primed with technical knowledge of the latest designs. But that is just another feature change in a surface pattern of market appeal. And hardware is a poor substitute for knowhow.

Handling Equipment Helps Accelerate Product Flow

Edward W. McCaul—A new trend in plant layout is evident in the rapidly changing use of material handling equipment for clearing aisles, removing obstructions between operations, and generally providing greater safety around all work stations. Examples:

- Feeding work stations with supplies automatically from overhead, rather than

WALTER A. GARRETT
Marketing Mgr., Strapping
Brainard Steel Div., Sharon Steel Corp.
Warren, Ohio

JOHN H. MORAVA
President
United States Steel Supply Div.
U. S. Steel Corp.
Chicago

W. SHERIDAN HUSS
President
Acme Steel Products Div.
Acme Steel Co.
Chicago

BERT E. PHILLIPS
General Mgr., Industrial Truck Div.
Clark Equipment Co.
Battle Creek, Mich.

with floor operated equipment.

- Handling scrap and waste products through chutes to disposal conveyors in the floor, to eliminate nonproductive motion near an operation.
- Automatic dispatching of subassemblies or finished products with trucks on towing conveyors that are imbedded in the floor.
- Integrated use of stacking cranes with conveyor racks, to save floor space for work in process between operations and departments.
- Reduced inventory or work in process by automatically dispatching small quantities at frequent intervals.

Handling Equipment Makers Help U. S. Firms Compete

L. West Shea—The year ahead doesn't present a clear picture of economic well-being. Manufacturers of material handling equipment recognize that condition and plan to do something about it. Executives of those firms realize that all industry is trying to improve its competitive position among foreign and domestic manufacturers.

The material handling industry is made up of many hundreds of firms that specialize in the manufacture of equipment such as cranes and conveyors, or lift trucks and tote pans. Increased cooperation among those manufacturers is helping the industry develop better integration of material handling.

It is difficult to list all the areas where improvement might be expected in 1961, but examples will point up areas to watch. Containerization will probably be improved and used more widely.

Storage facilities and handling equipment are being improved to permit operation of equipment in narrower aisles and at increased heights.

The material handling operation is also being improved through increased automation.

STEEL STRAPPING

Steel Strapping Materials Get Better Finish, Dimension

Walter A. Garrett—Developments in steel strapping materials are limited to two noticeable changes:

- Cold rolled steel is gaining popularity for heavy duty strapping, providing closer tolerances.
- Finishes are being improved for better corrosion resistance. They make for better appearance and improved operation of power strapping tools.

In the area of new tools, power draping is one of the newer developments in the industry. And a lot of emphasis is still being put on automation.

Handling Costs Are Reduced With Combination Concept

John H. Morava—Metalworking industries will be faced in 1961 with a continuation of the cost-profit squeeze that characterized 1960. Much attention has been devoted to the reduction of direct costs through improved technology, but the opportunity to achieve indirect cost savings, by combining units to reduce total handling, still remains.

Recently developed, power operated tools for round and flat steel strapping have stimulated new approaches to the study of material handling methods.

Steel strapping engineers are determining the most efficient ways to use the many new tools that are available. They are applying some of the techniques learned in the steel service center industry to ferret out the hidden costs of material possession. Other questions being answered: Does a process call for round or flat steel strapping? Should strapping be applied manually, or with power? Should small, portable strapping machines, or large, automatic ones be used for a particular operation? For the first time, strapping tools are available to meet all those conditions.

Powered Strapping Tools Emphasized as Cost Savers

W. Sheridan Huss—Powered machines for applying steel strapping continue to point the way to production economies in widely diversified industries. In the packaging or unitizing area—the point immediately after the final production operation and inspection—steel strapping makes a major contribution in any material handling project.

Strapping machines are pneumatic, hydraulic, or electrically powered for semi-automatic operation, applying one or more straps in each cycle.

Strapping stations are integrated with accessory contributions to accurate placement and faster strap feed. Examples: Powered strap feed units and tracks, indexing tables, package elevating devices, and strap threaders for feeding under skids or between the faces of a supporting pallet.

Package stops are co-ordinated with powered rolls and powered conveyor feed to and from strapping stations.

LIFT TRUCKS

Planned Replacement Trend Gains in Material Handling

Bert E. Phillips—The metalworking industry will see a break with tradition in material handling this year. Planned replacement programs will be used in acquiring and applying equipment. The equipment will be used for a predeter-

Handling and Packaging

LESTER M. SEARS
Chairman, Towmotor Corp.
Cleveland

HOWARD M. PALMER
Vice President & General Sales Mgr.
Lewis-Shepard Products Inc.
Watertown, Mass.

W. A. MEDDICK
President & General Manager
Elwell-Parker Electric Co.
Cleveland

mined number of years, based on its profitable life expectancy in a particular operation. Then it will be traded in on new machines. Such a program, properly set up, reduces obsolescence and high maintenance costs because equipment is replaced before it requires expensive servicing.

Many firms have no definite policy for the replacement of material handling equipment. But new and more accurate cost analysis techniques and upgraded standards of efficiency show that the lack of such a policy can be costly and embarrassing.

As equipment gets older, it costs more to maintain; it becomes less efficient and productive. Production capacity of a plant can be seriously handicapped by outmoded, patched up equipment.

That realization and competitive pressures should spur companies to examine purchasing policies, and make changes that will help keep handling equipment near peak efficiency.

Increased interest will be shown in methods of acquiring and financing handling equipment. Leasing and rental (especially rental with maintenance) will be given much more consideration. In many situations, those alternatives to outright purchase will be the quickest, most economical way to implement planned replacement programs.

Philosophy of the Compact Invades Lift Truck Field

Lester M. Sears—Several significant trends seem to be starting for material handling equipment. Example: Demand for compactness in the design of fork lift trucks is growing steadily.

Closely related to those trends is industry's ever increasing struggle for space. In spite of the attention it has received in industrial construction in recent years, storage space in plants and warehouses remains at a premium. Making wasted space usable, stacking materials higher and more efficiently, and cutting down on aisle widths to gain more tiers on present floor space—those are some of the most immediate requirements in industry. Lift truck manufacturers, anticipating those needs, are ready to meet them.

Interest is increasing throughout industry in powerful units that are streamlined and compact—built to travel easily through congested areas and operate in narrower aisles. One such unit is a fork lift truck that stacks materials on either side of aisles 4 to 5 ft narrower than average.

The trend toward compactness is also evident in higher capacity lift trucks. Units that can handle loads weighing up to 12 tons are being given the "compact look." They are being designed to meet the demand for a lower silhouette, which gives them added stability and traction, especially in outdoor operations.

Demand for lift trucks offering greater versatility is growing—it should continue to grow in the coming months. Multipurpose lift trucks able to perform a variety of handling operations (from receiving to shipping) are directly needed to help industry accomplish its immediate objectives—faster, more effective handling, without prohibitive capital investment.

To meet that need, industry will probably lean strongly toward double duty, fork lift trucks, built to stack heavy loads on tiers 12 to 15 ft high, and to drive directly into highway or rail carriers for swift, nonstop loading.

Better Design, Application Boost Lift Truck Efficiency

Howard M. Palmer—New industrial truck designs and applications have created new dimensions for material handling systems. Continuous development will provide more advanced equipment for greater efficiency in plants and warehouses.

- **In design**—Equipment with automatic controls, greater work capacity, and faster operation is being developed by manufacturers. More attachment designs are being offered, so one truck can do several handling operations. Wider varieties of equipment are being designed for special or complex handling jobs, or for more sophisticated systems.
- **In application**—More recognition is being given to the advantages offered by modern equipment designed for specific jobs. The material handling staff engineer, equipment salesman, and consultant will participate more frequently in the solution of handling problems. Floor areas and ceiling heights in new construction are being correlated with available handling equipment for more efficient operation.

Management and operating officials will take a closer look at plant and warehouse handling. It is an area where profit margins can be increased through handling efficiencies, increased output, and space savings. Alert users find that addition of more equipment can substantially increase production in key spots, further increasing the profit margin.

Better Batteries Increase Demand for Electric Trucks

W. A. Meddick—Greatly increased markets for electric powered industrial trucks are the direct result of new designs in storage batteries. Today's batteries offer far greater capacity per cubic foot of space—an increase of more than 50 per cent in the last four years.

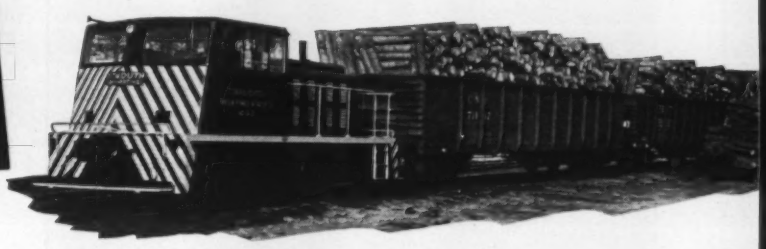
Now electric industrial trucks can travel at higher speeds and make faster lifts. And the cost of operating a battery powered truck is less than that of other types. Greater battery capacity permits the application of electric models where they couldn't be used previously because of the high speeds or long operating hours.

Electronic trucks are being used more

PLYMOUTH® LOCOMOTIVES with Torqomotive Drive

3 TO 80 TONS

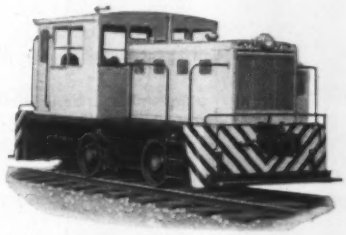
Industry's Smoothest Switchers



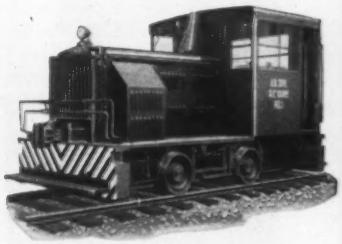
Here's the lineup of well-known Plymouth power in models from 3 to 80 tons . . . narrow or standard gauge . . . Gasoline or Diesel . . . mechanical or Torqomotive Drive . . . Diesel-Electrics. Records of users show Plymouth's economy, efficiency, dependability. Find out how these profit characteristics can improve your operation and cut costs.

PLYMOUTH LOCOMOTIVE WORKS
Division of The Fate-Root-Heath Company
Dept. A-1, Plymouth, Ohio

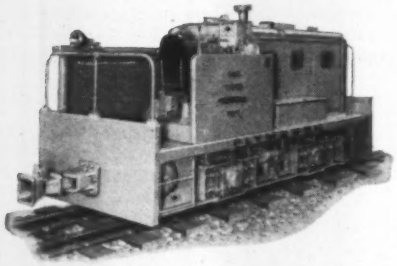
SINCE 1914 Plymouth Locomotives have been used for heavy hauling and switching jobs. They have proven themselves in year after year service with rock bottom economy, maximum availability, minimum down time. Pictured above is the new WDT Cab-in-front model, 40 tons, in service hauling pulpwood. Both the MDT and WDT are available in this model or in the standard models shown below.



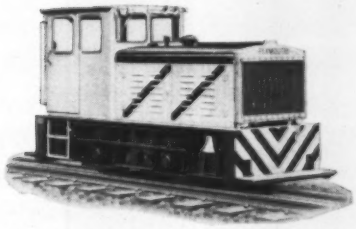
M SERIES, 25, 30, 35 or 40 tons, Diesel or gasoline, mechanical or Torqomotive Drive. This is the standard model, rear cab.



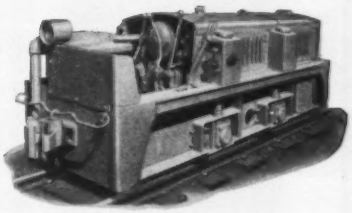
J SERIES, 12, 14, 16, 18 or 20 tons, Diesel or gasoline, mechanical or Torqomotive Drive. Available on 4 or 6 wheels.



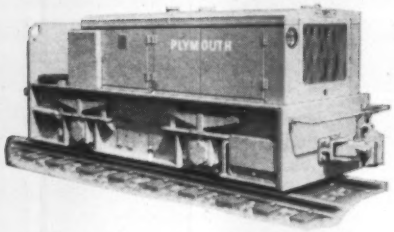
J SERIES Mine-O-Motive, 15 to 25 tons. Diesel powered with exhaust conditioner, Torqomotive Drive. Approved under Schedule #24.



D SERIES, 8, 10 or 12 tons, Diesel or gasoline, mechanical or Torqomotive Drive. Cast or Welded Frame.

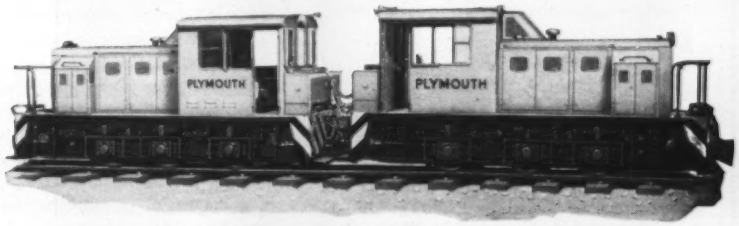


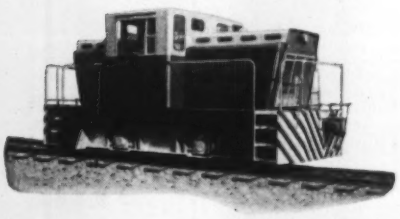
F SERIES, 5, 6, or 7 tons, available as mine type (illustrated) or cab type. Torqomotive Drive, short wheelbase.



DMS SERIES Mine-O-Motive, 8, 10 or 12 tons. Diesel powered with shaft drive to both axles, full power shifting. Approved under Schedule #24.

CR SERIES, 40 to 60 tons. Diesel powered with shaft drive to both axles, full power shifting, Torqomotive Drive. Speeds to 35 MPH.





PLYMOUTH TANDEMS—M or W Series 50 to 80 tons. The M or W Series can be built for tandem, single control operation, up to 80 tons on either 8 or 12 wheels. Each locomotive can also be operated individually.

**Torqomotive Drive;* Plymouth transmission coupled to hydraulic torque-converter.

PLYMOUTH® LOCOMOTIVES

PLYMOUTH LOCOMOTIVE WORKS

Handling and Packaging

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Executive Secretary, Hoist Manufacturers Assn.
Executive Secretary, Electric Overhead Crane Inst.
Washington

R. C. SOLLENBERGER
Executive Vice President
Conveyor Equipment Manufacturers Assn.
Washington

R. F. RICE
Manager, Crane Dept., Whiting Corp.
Harvey, Ill.

where materials handled present a fire hazard, or where materials could be contaminated by fumes. Example: In the handling of food products.

In the future, developments in truck controls will make for still smoother operation. And more automatic controls will be used.

Fuel cells should replace batteries in industrial trucks—perhaps in two years—and further reduce operating costs.

CRANES & CONVEYORS

Application to Get Emphasis In Material Handling Field

Joe H. Peritz—The immediate challenge to crane and hoist builders is one of product application rather than revolutionary design changes. Rapid developments in materials, products, and production techniques will demand equally rapid (and novel) solution of material handling problems. Systems will be more complex and highly integrated, requiring higher speeds and more sensitive controls, permitting increased duty-cycle operations. Automation will thoroughly test the ingenuity of the material handling field engineer.

Crane and hoist designers will adopt those materials and components that further the trend toward greater efficiency, with reductions in unit weight, size, and cost. Hydraulics, plastics, electronics, and miniaturization will bear watching.

Domestic and foreign competition are so severe that production costs must be cut to the bone for survival. Too many plants are trying to use slow, outmoded, prewar cranes and hoists in new, fast moving processes, with the latest automated tools. Modernization or replacement of material handling equipment is the only answer.

Crane and hoist builders re-emphasize full use of air space as a means of reducing costs and increasing productivity. Material handling through the air will be a vital factor in the inevitable expansion and modernization of successful plants of the future.

Material Handling Efficiency Can Insure Profits in 1961

R. C. Sollenberger—It is easier to make accurate predictions about the distant future than to call the shots for the near future. Signs of spurts in capital equipment buying are nonexistent; and there is no sign of a great drop in 1961. If we move along at the 1960 rate, 1961 should be a fair year from the volume standpoint. Competition will be strong, but prices should remain stable because of the many floors under costs. How profitable 1961 will be depends on the skill of management in reducing costs and increasing productivity.

One of the last areas that management can control is that of handling materials. That should encourage the purchase of mechanical handling equipment of all kinds—conveyors in particular because of their ability to deliver a constant, readily controlled stream of material where it is wanted and when it is needed.

Long distance transportation of materials by conveyors is moving ahead. In the handling of bulk materials, developments in conveyor belting and carrying elements permit handling of greater tonnages on the same width of belt over greater distances, with fewer transfer points between conveyor flights.

The conveyor system has become the work horse of automated processes in the bulk and unit handling fields. In many installations, the conveyor is part of a production machine. The conveyor engineer has been transformed from a man skilled in one branch of engineering into a man of parts, with skills extending in many branches. Memory systems, sensing devices, weight control, quality control, computer scheduling, self-correcting systems, temperature control, and automatic inspection are some of the functions and components that may be associated with modern conveyor systems.

From handling things to moving people has been an easy and logical step. More moving walks (conveyors for people) are being installed in transportation terminals, amusement parks, stadiums, supermarkets, hotels, parking lots, banks, and stores.

Automatic Crane Controls Boost Worker Productivity

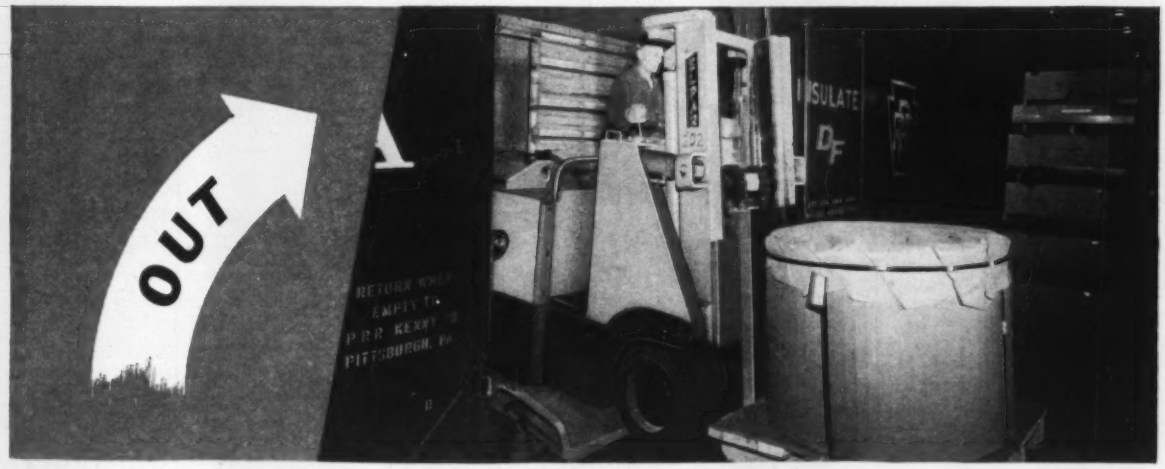
R. F. Rice—Because our peacetime economy calls for maximum productivity from labor, manufacturers are keenly interested in cranes that will do lifting and traveling operations quickly and with minimum attention. If a crane is to perform repetitive operations, the operator can also control other equipment. Example: In the charging of foundry cupolas, automatic crane controls permit the crane to be started through its operating cycle without operator attention once the charging bucket is attached. That permits the operator to prepare the next charge with other automatic or semiautomatic equipment.

Substantial savings are also possible if a crane in a long building can be called automatically into a certain area, where workmen on the floor can control it with pushbuttons. In a more refined control setup, a radio control carried by the operator would send signals to the crane. The signals would actuate magnetic contactors, determining the speed and acceleration of various crane motions. Such systems are being developed and tested. They should be available for use on cranes in the next few months.

Users of heavy duty cranes are giving serious consideration to alternating current motors and controls in applications where direct current motors have been the standard. Development of heavy duty,

ELPAR TITAN

...For "big" truck maneuverability



Handles 15,000 to 20,000 pound coils ...will operate in box cars, narrow aisles and congested areas.

No other truck in this capacity range can match the TITAN series for maneuverability. Its as easy to operate as the family car and for maximum handling efficiency it is equipped with extra fast lift and travel speeds. Particularly valuable is the TITAN's fast accelleration which saves minutes when maneuvering in tight spots.

The Titan also establishes a new standard for dependability and easy maintenance that is unmatched by other trucks in the heavy duty class. You'll find a host of new safety features too.

There are four standard models—15,000 to 20,000 pound capacity—each one engineered to handle heavy loads faster and at lower cost.

Write for this TITAN Series Brochure—contains complete design and operating data.

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COLD FINISHED STEEL BARS

Over the years, Wyckoff production facilities have kept pace with the most exacting requirements of all specifications involving: optimum machining properties . . . accuracy . . . outstanding finish . . . controlled physical properties through diversified furnace treatments. For the finest in cold finished steels—SAVE—specify WYCKOFF.

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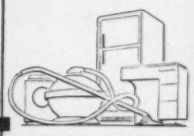
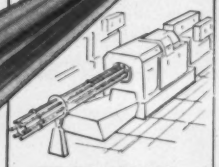
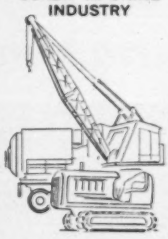


APPLIANCES

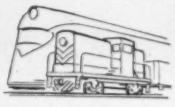


SCREW MACHINE INDUSTRY



CONSTRUCTION

AUTOMOTIVE

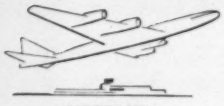


RAILROADS

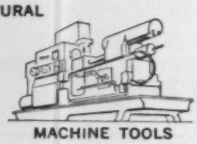
FASTENERS

AGRICULTURAL

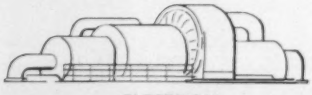
ORDNANCE



AIRCRAFT



MACHINE TOOLS



ELECTRICAL

Handling and Packaging

FRED L. HOOPER
Executive Vice President
Cambridge Wire Cloth Co.
Cambridge, Md.

alternating current, mill motors is expected in the near future. They will be available for industrial cranes and should be economical for many applications. New type, static controls, with saturable reactors instead of contactors, make alternating current cranes more suitable for heavy duty service. They offer excellent operating characteristics and durability.

Wire Belts Are Adaptable To Many Special Jobs

Fred L. Hooper—A fast moving industrial technology constantly emphasizes the need for a versatile conveying production system that simultaneously processes or treats the product as it moves from one point to another. Manufacturers of woven wire conveyor belting are meeting that challenge with many new developments.

In some belt constructions, each component is fully collapsible to permit instant cleaning. Retaining edges help increase payload. Special attachments often position products that are being treated. And combinations of chains and metal mesh belts provide a conveying medium capable of moving products faster than 500 ft a minute.

Austempered steel belts stand up to severe abrasion and heavy load conditions often found in foundries and other metalworking plants. And synthetic coatings for the metal base of the belt protect it from corrosion.

New alloys are extending the use of belts in temperatures above 2000° F. New components insure better belt travel, and flat wire belts make for economical installation where sprockets are required for driving.

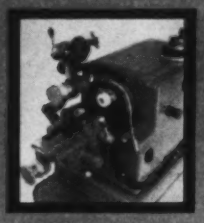
SPIROPOINT*

makes twist drills produce at Breeze Corporations, Inc.

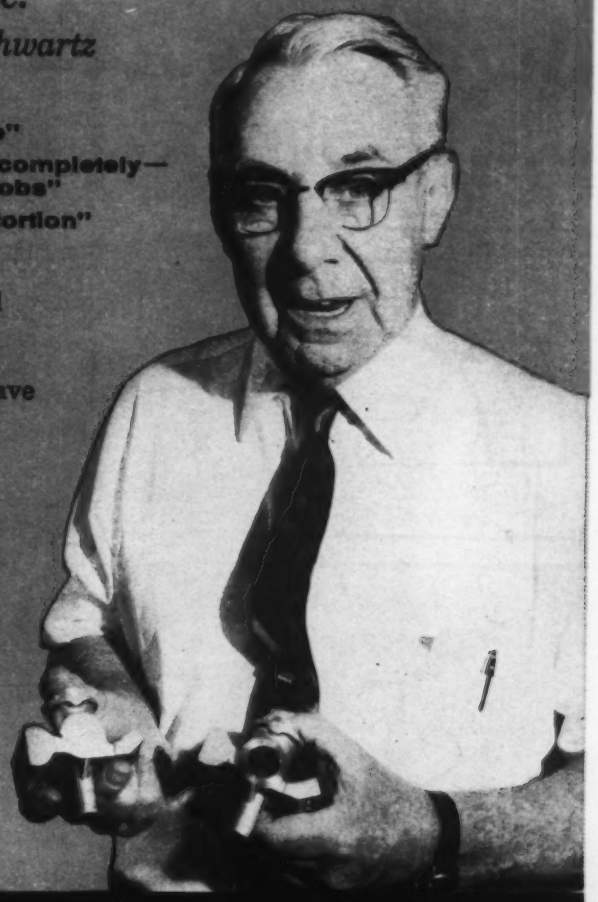
says Works Manager Harold Schwartz

"...50% greater drill life"
"...up to 40% saving in drilling time"
"...centering operations eliminated completely—reaming unnecessary on many jobs"
"...70% reduction in workpiece distortion"

Breeze Corporations, Inc. of Union, New Jersey, executes complete design and production of precision electrical, electro-mechanical, and hydro-mechanical components and systems. Drilling costs have been cut at Breeze because, with spiral points, all holes are "right on center, round, smooth, and right to size—*at both ends!*", Mr. Schwartz stated.



* Cincinnati SPIROPOINT® Drill Sharpener applies the new spiral point geometry to standard twist drills in a matter of seconds.



Works Manager Schwartz holds "Guillotine" safety device used on helicopter hoists. Production drilled holes 1½" deep are held to .001" tolerance on straightness.

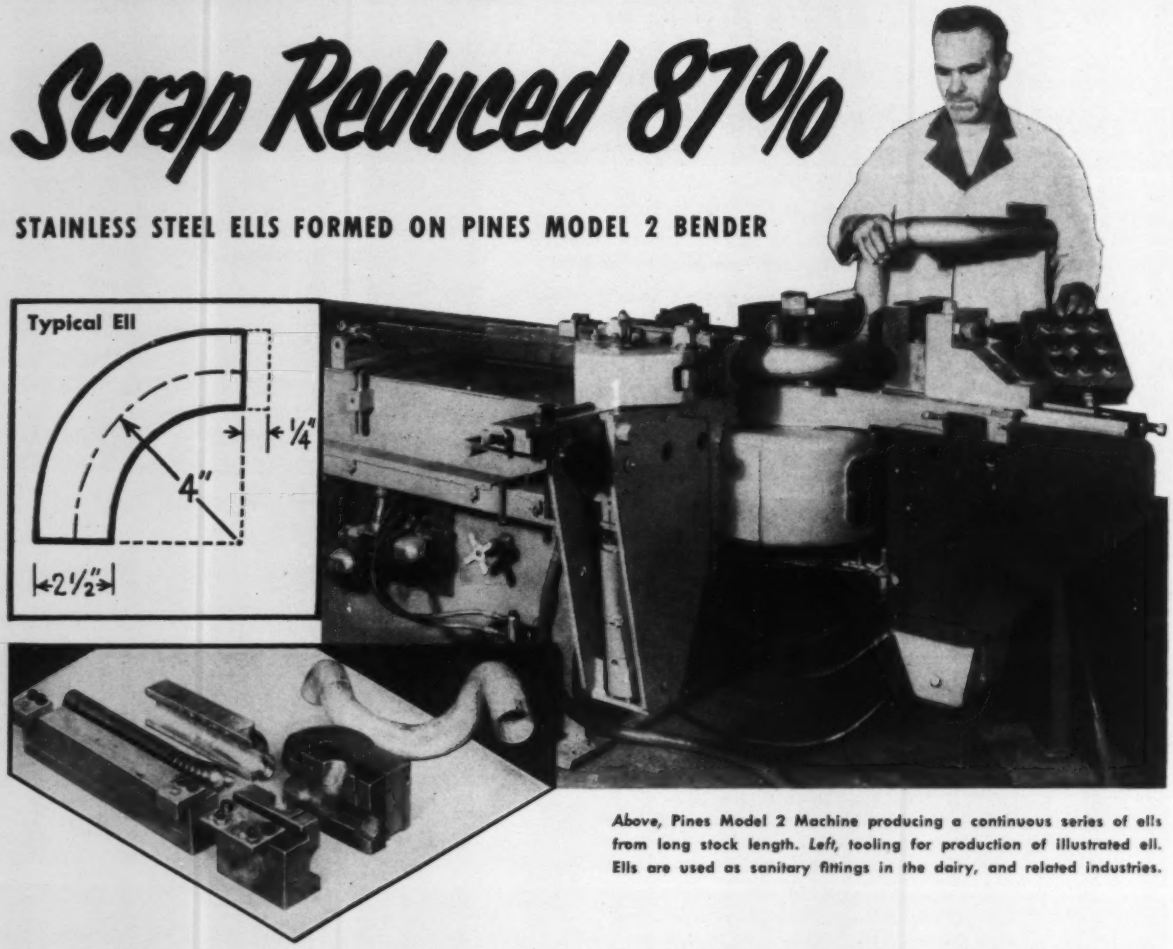
Aluminum slip ring housing 3' in diameter has 576 holes. The ¾" holes are drilled through ¾" metal with spiral point drills in one-third the time normally required. Change in shape of the relatively fragile casting was negligible.

¾" drilling of this missile control launcher part is held to .001" tolerances on hole location and diameter—center drilling and reaming operations eliminated.

CINCINNATI LATHE AND TOOL CO.
Cincinnati 9, Ohio
HYDRASHIFT Lathes • CINCINNATI Drilling Machines • SPIROPOINT Drill Sharpeners

Production Up 400%
Scrap Reduced 87%

STAINLESS STEEL ELLS FORMED ON PINES MODEL 2 BENDER



Above, Pines Model 2 Machine producing a continuous series of ells from long stock length. *Left,* tooling for production of illustrated ell. Ells are used as sanitary fittings in the dairy, and related industries.

Here's another illustration of how cold bending the "Pines-Way" can increase output and reduce operating expenses. This Pines Model 2 Machine has enabled Alloy Products Corp., Waukesha, Wisconsin, to produce four times more stainless steel ells and cut scrap losses up to 87% over their previous method. Prior to installation of this machine, short lengths of tubing were filled with lead and bent on a press. From 2″ to 3″ were trimmed from each bend, and production was 30 ells an hour. Today, these bends in Type 304 stainless are produced in sizes from 1½″ to 3″ O.D., walls of .050″ to .065″, at an average of 125 an hour. Scrap loss through material trimmed away has been reduced to ¼″ per finished piece.

Smooth, Small Radius Ells Produced in Continuous Series

Ells are produced as a continuous series of 90° bends in long stock lengths. All radii are less than 2x tube diameter. For example, 15 ells are bent in a 10 ft. length of 2½″ O.D. tubing on a 4″ centerline radius. Individual ells are saw cut from the spiral. Only ⅛″ of the costly stainless, the width of the saw blade, is lost from each end.

Compound Tooling is Major Factor In Scrap Reduction

Quality, scratch-free bends are produced on tooling that includes compound bending and clamp dies, a mandrel, and a wiper die. A cleat in the horizontal groove of the bending and clamp dies reduces the stock length clamped for the first bend. Succeeding bends are made by clamping on the preceding bend. Call on Pines bending experience and tooling skill for the answers to *your* bending needs.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

662 WALNUT • AURORA, ILLINOIS

WRITE FOR *FREE* CASE STUDIES

For further case study reports on the cost-cutting advantages of cold bending, write for free copies of "Pines News." Catalog also available.

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

JOSEPH C. BYSTRICKY
Project Engineer, Alemite Div.
Stewart-Warner Corp., Chicago

W. J. BROWN
Staff Product Application Engineer
Marketing Technical Service Div.
Gulf Research & Development Co.
Pittsburgh

R. Q. SHARPE
Manager, Industrial Technical
Div., Products Dept., Socony
Mobil Oil Co. Inc., New York

A. J. STOCK
Research & Development Mgr.
Acheson Colloids Co., Div. of
Acheson Industries Inc.
Port Huron, Mich.

TECHNICAL PROGRESS

Lubrication

Centralized lubrication is getting a boost from bulk delivery and multipurpose greases. More dry films are being used

High Viscosity Oils Misted By New Heated Air Technique

Joseph C. Bystricky—A recent development in oil mist, centralized, lubricating systems uses "heated air" (up to 300° F) to mist oils in viscosities previously thought impossible. Straight mineral and compounded oils in viscosity ranges up to 25,000 SSU at 100° F are being used while experimental misting of oils up to 75,000 SSU seems practical. Oil mist outputs considerably higher than previously possible are now being achieved even with these high viscosity oils.

Some proven applications include use of 2500 SSU E.P. oils on work roll and backup roll bearings in rolling mills.

Further applications of heavy gear oils on large gears have been successful.

Petroleum Wax to Be Tried As Palm Oil Substitute

W. J. Brown—Efforts will be made this year to develop palm oil substitutes using petroleum wax as a major component. It's needed to enable high speed tin plate rolling on tandem cold mills.

Petroleum waxes in many forms will offer high load carrying for heavy reductions and excellent burnoff properties in annealing. They will differ from palm oil by remaining a liquid at low temperatures (handling and storage is easier). They can be easily emulsified for circulation systems or can be applied without an emulsifier for use in direct systems.

In addition to cold rolling steel, you can use them in drawing various metals using the oil neat for deep draws and emulsified for less severe draws. Easy removal with hot water or mild alkaline rinse is one of the advantages.

Interest in Multipurpose Oils, Greases Increases

R. Q. Sharpe—The use of products designed for multiservice applications continues to expand in both lubricating oils and greases. Products of this category make it possible for a user to reduce the number of lubricants required to successfully service a wide range of equipment. Simplified purchasing, storage, and handling procedures are some of the advantages. Misapplication is also prevented.

A trend toward the increased use of emulsions or aqueous mixtures for the machining of metals will change the emphasis on products and machining practices. With the increasing use of heat resistant metals, special coolants will continue to get substantial attention.

Development work is continuing with fire resistant fluids and water-in-oil emulsions (in the coal mining industry particularly).

SPECIAL PURPOSE

Conversion, Dry Film Coatings Fight High Vacuums, Heat

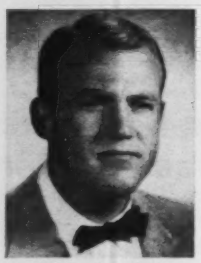
A. J. Stock—The problems of lubricating in high vacuums and at high temperatures

(*Please turn to Page* 253)

Lubrication

ALAN B. MYLER
Chief Engineer, Metalworking Oil Dept.
Sun Oil Co., Philadelphia

H. A. HARTUNG, Consultant
West Collingswood, N. J.



RALPH E. CRUMP
Chief Engineer, Electrofilm Inc.
North Hollywood, Calif.

K. L. BERKEY
Senior Project Engineer
Wright Air Development Div.
Wright-Patterson Air Force Base, Ohio

FRED LUCKENBACH
General Manager, Commercial
Development, Foote Mineral Co.
Philadelphia

(*Continued from Page 247*)

not only apply to machine lubrication but also to metalworking processes where metals are being formed under the most unusual protective atmospheres, and machining operations are being carried out at elevated temperatures.

The current approaches to high lubricants is in conversion coatings and dry films containing solid lubricants. Approaches such as synergistic combinations of solid lubricants have been improving dry films.

New Alloys, Processes Hike Demand for Special Fluids

Alan B. Myler—There is a continuing demand for specialized coolants and lubricants for new alloys, machines, tools, and processes.

One example is aluminum cylinder blocks. Machining is done on huge transfer machines which must be kept clean. Aluminum chips don't wash away like cast iron chips. Contrary to general opinion, aluminum is more difficult to machine.

In belt and form grinding new techniques and applications have forced the development of better, nonemulsifying, grinding oils. One of the developments is in the rolling of stainless steel strip. Here, it has been found that a belt grinding operation to remove crown and surface imperfections helps produce higher quality stainless. The belt grinders run in a flood of oil. New alloys for jet engine blades have necessitated the development of specialized grinding fluids.

Problems Cited Include High Vacuum, High Heat

H. A. Hartung—The main problems include high temperature and high vacuum lubrication, increasing ball and roller bearing life and reliability, and extending the lubrication intervals of automotive and industrial equipment.

In high temperature lubrication, work is being done on gas bearings, high temperature synthetic liquids, and novel solid lubricants. Certain solid lubricants are showing great promise in solving space lubrication problems. Some conventional liquids also look very good.

Much research is being done on the life and reliability of ball and roller bearings, from the point of view of materials and lubricants.

Equipment manufacturers are extending the lubrication periods of equipment, particularly automotive. While this trend is natural, care must be taken not to go too far. Recommendations for extended lubrication periods should not exceed the ability of existing high quality lubricants to perform.

Solid Film Lubricants Win More Applications

Ralph E. Crump—A series of technical improvements amounting to a major breakthrough in the solid film lubricant industry has been achieved. A corrosion and solvent resistant, air dry, solid film lubricant has been developed which can be used in the most automatic conveyorized system.

The last year has seen three automotive companies write specifications around solid film lubricants; four or five more will follow in 1961. Applications, such as lock mechanisms, brake mechanisms, window crankup units, carburetor parts, and other linkages, are typical of the automotive applications.

An air drying, water soluble, metalworking solid film lubricant has been improved and is solving problems in the metal spinning and drop forging industry. Advantages include low cost and ease of application. The material may be washed off with 140° F water when the parts are drawn or stamped.

Aircraft, Space Travel Push Work on Nonorganic Lubricants

K. L. Berkey—Organic materials will suffice for some time for the gas turbines and rockets that are now being used in aircraft and space vehicles. Flight vehicle power engines (because of their unique environments) will require something new. The units generate secondary power, usually electrical.

In addition to the organic fluid studies, work is underway on organometallic and inorganic materials and even on metals such as potassium, rubidium, and mercury in the liquid and vapor phases. Gas lubricated bearings are also being studied.

New gas turbine engines are expected to greatly increase gear and bearing unit loads. Developments such as the vacuum melt, bearing steels and lubricant, load carrying additives should allow reasonable gear and bearing life.

Demand for Lithium Greases Growing in Several Areas

Fred Luckenbach—Lithium-base grease applications are growing. While over-all demand for lubricating greases may slowly decline, automotive sealed bearing lubrication will increase the requirements for durable, lithium, multipurpose types. Industrial, farm, and other nonautomotive uses are also increasing.

Some of the newer greases could use lithium advantageously. The diester and silicone types depend on lithium, prefer-

(*Please turn to Page 253*)

Throughout the steel industry, the Blaw-Knox name means exceptional service and the highest standards of performance. Behind this name are the engineering force and plant capacity necessary to meet steelmakers' most advanced requirements for modern automatic equipment. Blaw-Knox Company, 300 Sixth Avenue, Pittsburgh 22, Pa.

BLAW-KNOX

a

b

c

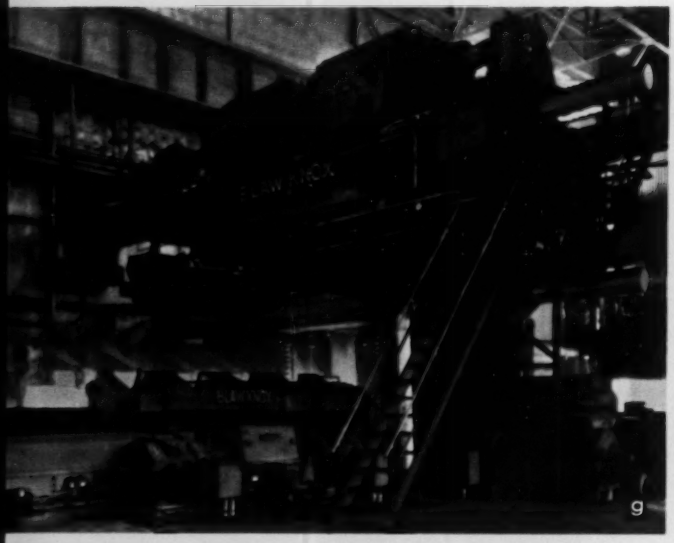
Rolling Mills and Processing Equipment for Shape Rolled Products

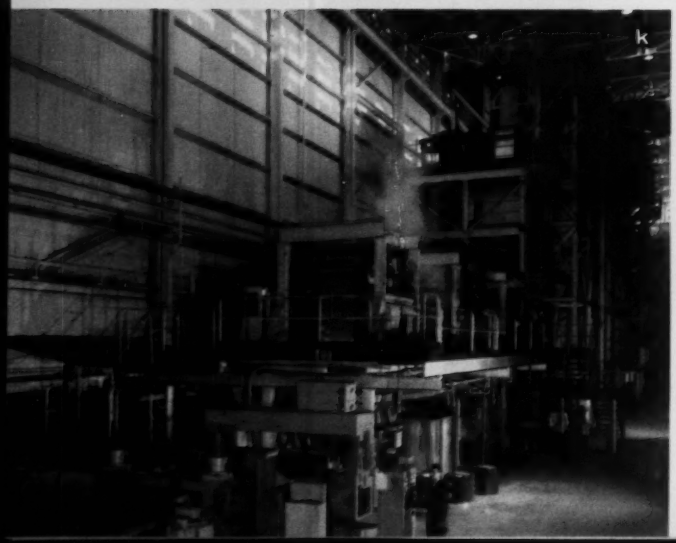
a Combination 46- x 114-inch Blooming-Slabbing Mill and 38- x 53- x 114-inch 4 high Plate Mill. b Wide Flange Beam and Structural Mill. c Merchant Mill.

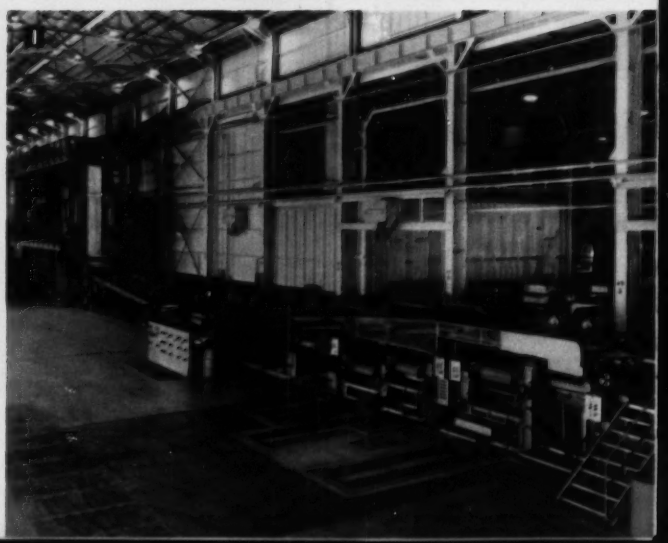
Rolling Mills and Processing Equipment for Shape Rolled Products (Continued)

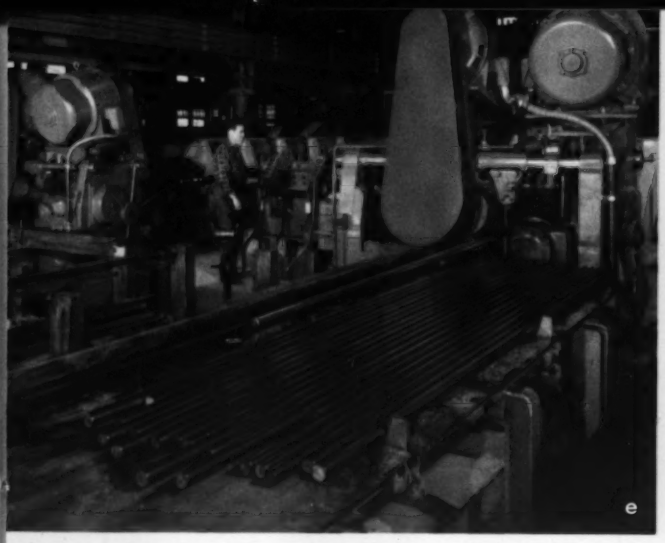
d Continuous Butt Weld Pipe Mill. **e** High Speed 2-roll Straightener in Cold Drawn Bar Line. **f** Roller Straightener for Hot Rolled Angles.

BLAW-KNOX





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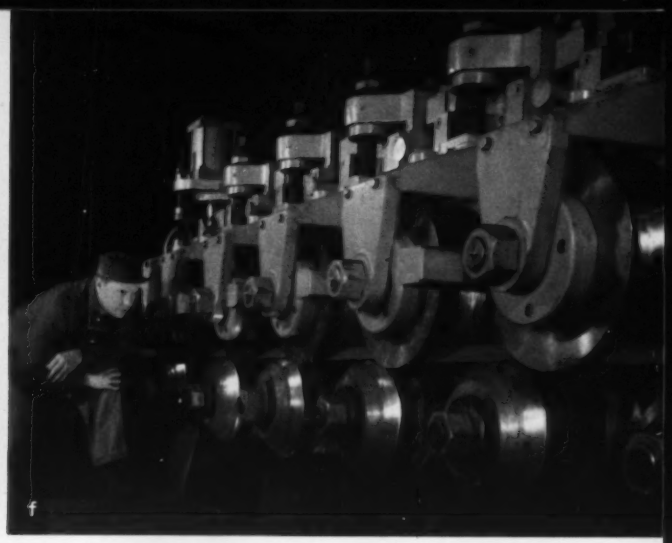
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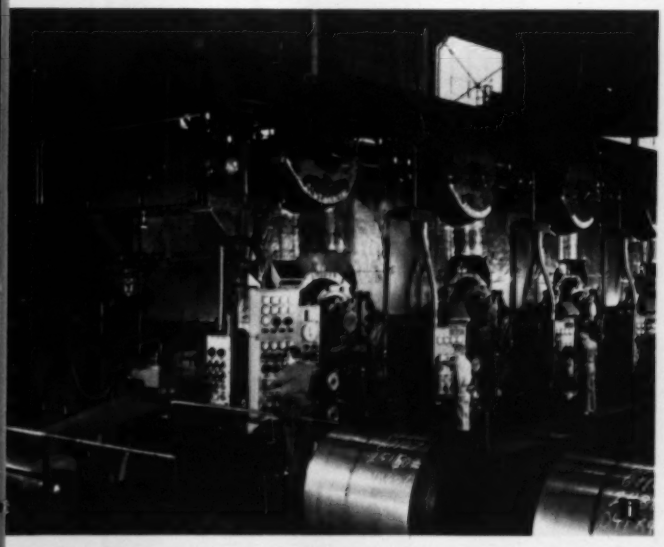

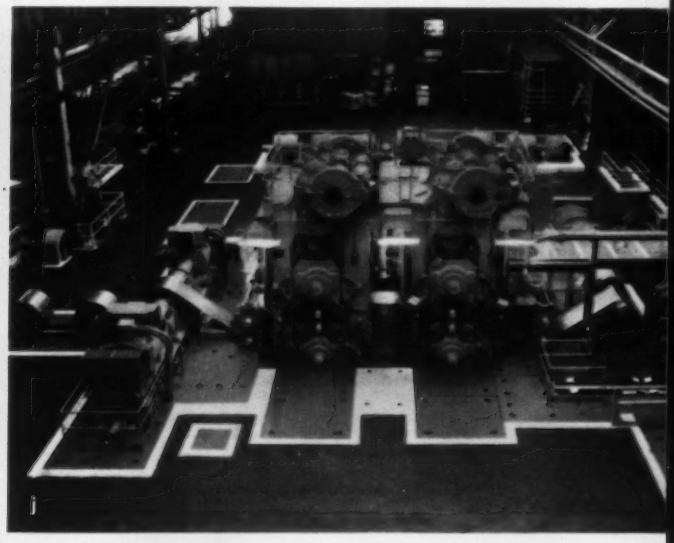
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Rolling Mills and Processing Lines for Flat Rolled Products

g 46- x 90-inch Universal Slabbing Mill. h 56-inch Hot Strip Mill. i 60-inch Tandem Cold Strip Mill. j 19- and 53-inch x 48-inch Twin Temper Mill. k Continuous Annealing Line. l Electrolytic Tinning Line. m Continuous Galvanizing Line.

n Iron, Alloy Iron, Steel and Alloy Steel Rolls.

o Foundry Products: Peels, Slag Pots, Charging Boxes, Ingot and Charging Cars, Ladles, Trunnions and Rings, Blast Furnace Hoppers and Bells.

p High Alloy Castings: Radiant Tube Assemblies, Furnace Parts, Continuous Annealing, Conveyor, Feeder, Deflector and Zinc Rolls, and Heat Exchanger Elements.

q Steel Plant Equipment: Ladle Additions Feeders, Autopours,® Dolomite Machines, Water-cooled Doors, Frames, and Reversing Valves.

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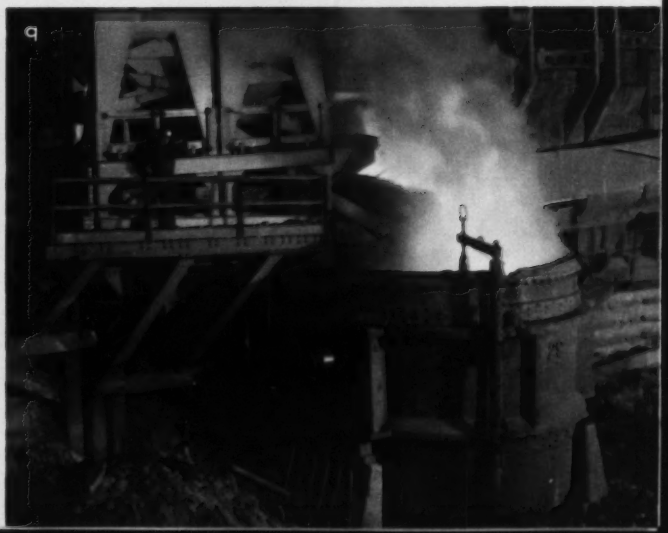


Lubrication

JONATHAN KLUDT
Executive Vice President & General Manager
Lincoln Engineering Co., Div. McNeil Machine & Engineering Co., St. Louis

JOHN R. McCOY
Technical Service Manager
Indiana Commercial Filters Corp.
Lebanon, Ind.

M. F. TROUTMAN
Sales Engineering, Esso Standard Div. of Humble Oil & Refining Co., New York

E. W. BAUMGARDNER
Sales Manager, Trabon Engineering Corp., Salon, Ohio

(*Continued from Page 248*)

ably in the form of lithium stearate. Lithium greases containing molybdenum disulfide have shown promise for special applications.

Lithium forms stable, semifluid greases of low viscosity. They're water resistant and can function effectively at low (down to −67° F) or high temperatures (350 to 400° F).

LUBRICATION SYSTEMS

Quality Important in Men, Equipment, Materials, System

Jonathan Kludt—We note two trends: Increased use of automatic centralized lubrication systems and an upgrading of personnel placed in charge of lubrication. It takes good men, good lubrication equipment, good lubricants, and a good system for daily checking the requirements of all machines to get the most productive output from machinery at the lowest unit cost of goods.

Skimping on any category doesn't save, it costs money. That's why lubrication equipment makers work closely with oil companies, machinery builders, and plant engineering and operating personnel.

Plant administration can be the most important category since management gets the job out of planning and into practice.

Points to remember: Industry pays workers more than $5 billion a year for maintenance: 1 out of every 12 workers is part of a maintenance force. It might take an oiler 18 minutes to lubricate 200 bearings on a machine (if he finds them all). An automatic system can do the job in 15 seconds and do it as often as required.

Gravity Filters Separate Oil, Water Base Fluids

John R. McCoy—Separation of lubricating oils and coolants is tricky under certain filtration conditions. It's relatively easy to filter a mineral oil or a water based coolant, but mix them and filtration becomes difficult. The filter surface blinds over and prematurely stops flow. The blinding is particularly troublesome with pressure or vacuum type filters. Mineral "tramp oils" get into water based coolants from sources such as leaking hydraulic systems, lubricating systems, and rust preventive coatings on metal being worked.

One simple way to remove "tramp mineral oils" from water based coolants: Pass them through gravity filters using nonwoven fabrics as the filter medium. Automatic indexing filters can be set up to automatically index the filter medium when it becomes blinded over with oil or plugged with dirt. The filters are particularly useful in roll mill operations that use soluble oil coolants and in metal cutting and grinding operations.

Bulk Grease Delivery Lowers Lubrication Costs

M. F. Troutman—Recent improvements in centralized lubrication equipment permit the movement of grease from large storage tanks through long distribution lines to individual lubrication systems. Large storage tanks can be located in the mill and can be serviced by the bulk grease hauler to eliminate in-plant handling of drums. The grease can be supplied at lower cost because of lower container expense.

Bulk grease systems will become standard equipment on new mill installations. Interest in bulk systems is already high and many plants in heavy industry are considering installations for 1961.

Presently, the majority of large consumers of grease receive and store their supplies in conventional 400 lb drums. When needed, the drums must be transferred from the storage area to the point of intended use, and attached to the centralized system serving the machine elements. Storing and handling can prove costly.

Multipurpose Grease Can Be Piped Throughout Plant

E. W. Baumgardner—The development and industry's wide acceptance of multipurpose grease have paved the way for the swing to bulk handling of grease and co-ordinated, automatic lubrication systems. Entire plants and mills are planned or being constructed with the refinery-to-bearing system of automatic lubrication.

Advantages: Multipurpose lubricants reduce storage and inventory problems. Contamination of grease (a maintenance headache) has been eliminated by having the sealed-in system. Zone or area pumping stations and reservoirs have been eliminated. Lubrication becomes a utility (you have grease on tap anywhere in the plant).

Lubricant is now loaded into special tanks at the oil refinery and taken to the mill or plant, where it is pumped into sealed reservoirs capable of storing up to 20,000 lb of multipurpose lubricant.

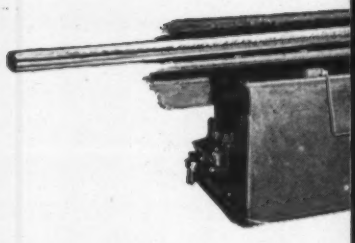
A pressurized supply line extends the full length of the mill or plant. Booster stations can be set up to compensate for pressure drop. You can plug in, tap in, or add a section for a plant expansion at any point along the line.

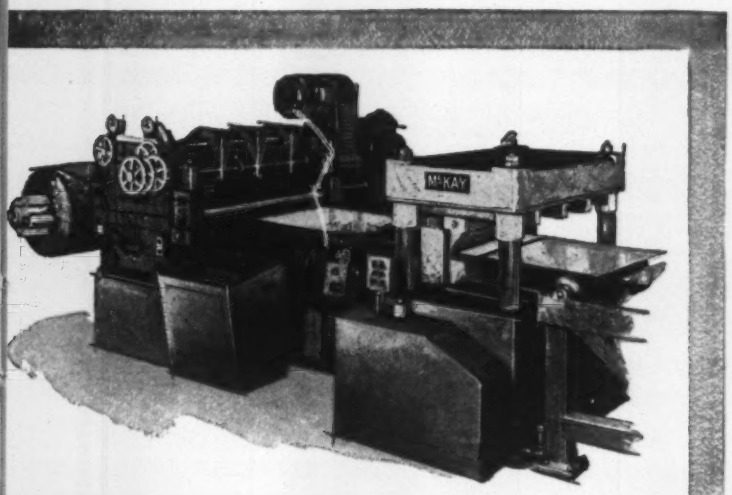
LOOK TO

McKAY MACHINE

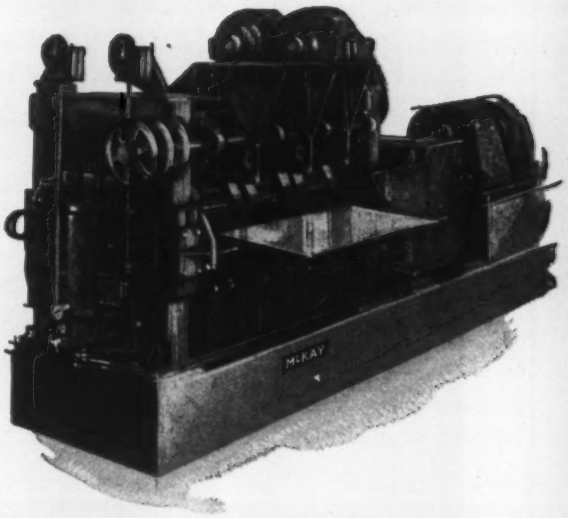
FOR PROGRESS IN METAL PROCESSING

McKAY PIPE MILLS





McKAYMATIC* DIE SHEAR LINES



McKAY ROLLER LEVELERS

No machine manufacturer puts more into its products than does McKay. Metal producers and fabricators have learned they can expect and get integrity and honest value—the most advanced design and engineering—the finest construction and service—when they specify McKay Machine metal processing equipment.

Look to McKay Machine in 1961 for more automatic machines, like those illustrated here, well conceived and skillfully developed to help you do your work faster, better and more economically than ever before.

The McKay Machine Company, Youngstown 1, Ohio.

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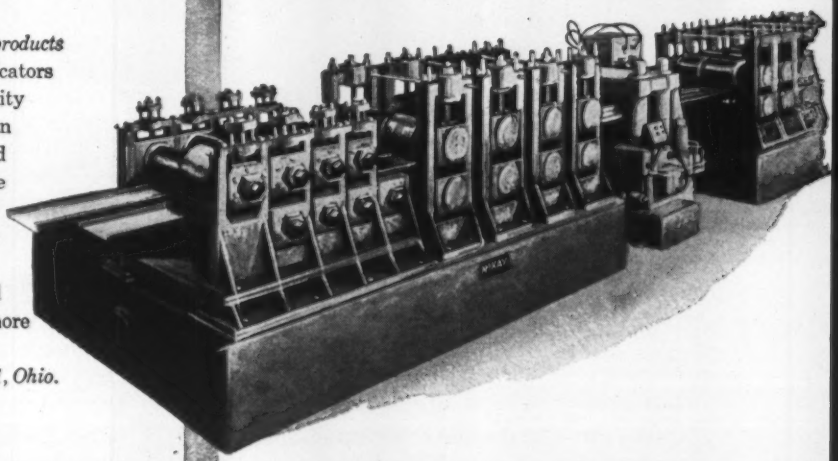
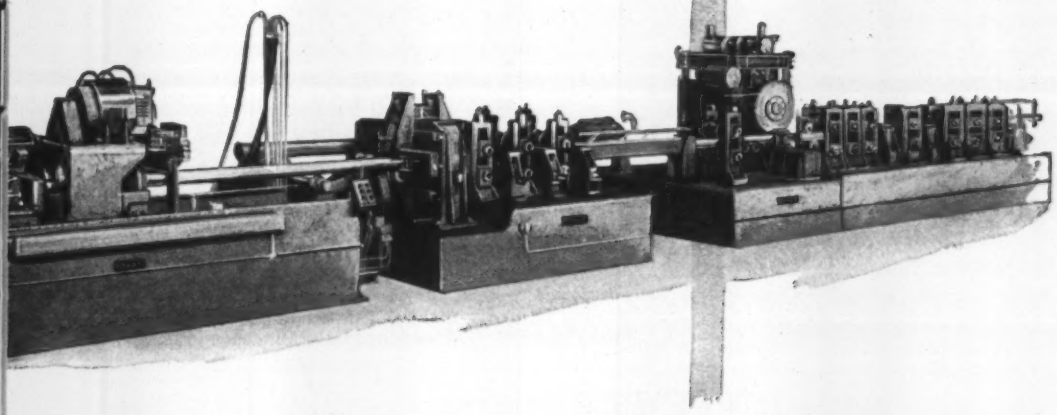
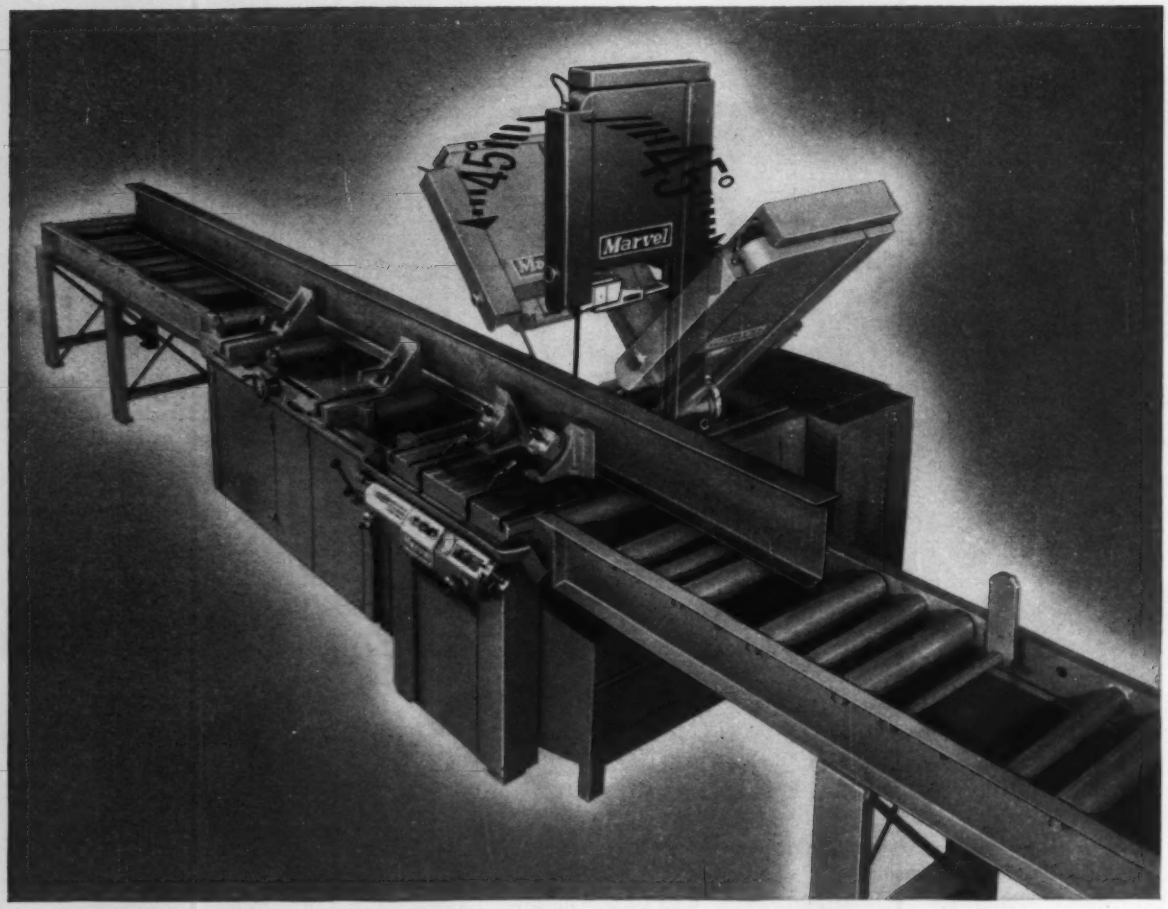


McKAYMATIC* FORMING MILLS





Tips Its Head To Cut Production Corners

Sawing 45° miters in any kind of material has always been a simple task for MARVEL Saws, but moving the work up automatically and making consecutive cuts on an angle was a problem, especially when the work was long and cumbersome.

This triple exposure photograph of a new MARVEL No. 81A All Hydraulic Heavy Duty Automatic Bar Feed Band Saw, illustrates how the upright head or column can be tipped 45° either right or left of vertical to make angle or miter cuts. The work is held stationary while the column, which carries the blade, is fed forward, meeting the work squarely to insure accurate cutting. After the cut is completed, the work is automatically moved up and measured, and another cut made.

Automatic miter cutting is just one of many exclusive universal features of these band saws. Designed to utilize every advantage of high speed steel band blades, MARVEL No. 81 Series Band Saws can handle almost any conceivable sawing job—from the smallest, most delicate work, up to 18" x 20" shapes.

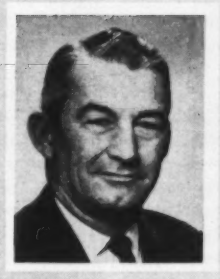
Only the MARVEL No. 81 Band Saws have the "SURE-LINE" Automatic Accuracy Control (basic patent applied for) which literally steers a blade to make a straight cut. This unit extends usable blade life as much as 50%.

MARVEL No. 81 Series Band Saws are proving themselves daily, as the most versatile machine tools in production metalworking plants.

For complete details, or a demonstration of MARVEL Sawing Equipment, write: Armstrong-Blum Manufacturing Co., 5700 W. Bloomingdale Ave., Chicago 39, Ill.

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades

HENRY E. JENSEN
Vice President-Engineering & Marketing
C&D Batteries Div.
Electric Autolite Co.
Conshohocken, Pa.



JOHN T. MONAHAN
General Mgr., Safety Products Div.
American Optical Co.
Southbridge, Mass.

D. W. MILESTONE
General Sales Mgr., Infra-Red Dept.
Perfection Div., Hupp Corp.
Cleveland

C. H. HEMPEL
President
Heresite & Chemical Co.
Manitowoc, Wis.

TECHNICAL PROGRESS

Service and Maintenance

Equipment to keep plants operating will be more compact, efficient, automatic. Look for emphasis on corrosion protection

New Rectifier Revolutionizes Industrial Battery Charging

Henry E. Jensen—Greater emphasis will be placed on the manufacture and use of highly efficient, static, charging equipment for the storage batteries used in electric trucks in 1961. Such equipment, made possible by the silicon rectifier, is unusually reliable; it virtually eliminates maintenance.

Completely automatic charging equipment, with no moving parts except for timing devices and rugged contactors or relays that require no adjustment, will be available for all sizes and types of industrial batteries.

Safety Product Manufacturers Plan to Diversify in 1961

John T. Monahan—Manufacturers of industrial safety products will continue to expand in 1961 to meet growing demands for adequate plant worker protection.

Products will be improved in appearance and effectiveness. And many new products will be introduced in 1961.

More leisure time for plant personnel is causing many safety equipment producers to think of protection for workers off the job. Many firms will branch into off-the-job protective products.

Research and development in metal-working industries must be accelerated to meet new hazards encountered in the use of new, exotic metals and other materials.

Infrared, Radiant Burner Gains Industrial Acceptance

D. W. Milestone—Introduction of the Schwank type gas burner has had a significant impact on industrial heating.

A powerful area source of radiation is provided with a relatively simple, atmospheric, cast iron gas burner and ceramic mat. The mat reaches a temperature of 1600° F after a few minutes of operation, delivering 24,000 Btu per square foot per hour.

In space heating, gas, infrared units provide instant comfort for spot, area, or total building heat because it first heats people and surrounding surfaces without regard for the air temperature.

Coatings Guard Containers Against Corrosive Materials

C. H. Hempel—Coatings and linings based on synthetic latexes and resins are a technological and commercial reality for use in highly corrosive environments. Coatings of that general type have been used decoratively for some time, but new developments are responsible for coatings and linings that can handle corrosive materials like phosphoric acid, ammonium hydroxide, and hot, caustic alkali solutions.

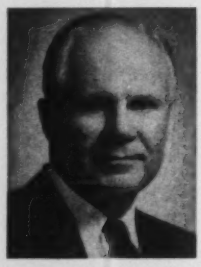
High resiliency and toughness, light color, ease of application, relative freedom from flammability during application, and high chemical resistance make those coatings and linings increasingly popular in the transportation of highly corrosive commodities.

In steel container linings, baked, pure

Service and Maintenance

WAYNE E. AULT
Manager, Engineering
Automatic Sprinkler Corp. of America
Youngstown

JOHN T. RYAN JR.
President
Mine Safety Appliances Co.
Pittsburgh



WALTER E. MORGAN JR.
Vice President
Walter Kidde & Co. Inc.
Belleville, N. J.

E. A. CARSEY
Assistant Chief Engineer
Kirk & Blum Mfg. Co.
Cincinnati

phenolic, resinous linings should show continued growth

Recently introduced to the steel pail and drum fabricator: A series of improved, baked, pure phenolic coatings and linings for one coat application on plain steel. Elaborate surface preparation is no longer necessary to insure adhesion. Chemical manufacturers should find such containers indispensable.

Rocket Age Makes New Demand On Fire Protection Systems

Wayne E. Ault—The steps in the production of a rocket motor—from raw material to finished device—are probably the most intricate and precise ever required. Complicated chemistry and chemical engineering employed in the selection, handling, and processing of liquid or solid fuel requires the genius of the scientist, the design capabilities of the engineer, and the best possible fire protection program.

The well organized fire safety program is necessary to the chain of production techniques and cannot be replaced in full measure by any insurance. Loss of life, production, product, or time is irreplaceable.

Many of the needs of such a fire safety program can be borrowed from the steel industry or elsewhere. Protection of warehouses, production buildings, and other industrial facilities is provided in most cases by automatic sprinkler systems. Protection has been developed for highly automatic and expensive machinery such as that used in steel mills. Fire protection systems are tailormade for oil cellars, reduction mills, power generation or transformer equipment, electric motors and controlrooms, and paint spray booths.

Specialized, automatic fire detection and extinguishing systems are being designed for the processing and handling of exotic fuels. "Millisecond" is a new word in the fire protection field. Techniques have been developed and work is continuing to acquire millisecond responses and operating times.

More consideration is being given to the design of production and handling equipment to prevent fire accidents, so far as humanly possible. Each component, each process, and each sequence of operations must be analyzed for its potential contribution to fire and accident.

Emphasis on Personnel Safety Helps Cut Production Costs

John T. Ryan Jr.—Metalworking people say the cost-price squeeze in their industry will be even more severe in 1961 than it was in 1960. So even greater effort must be turned toward reducing costs and improving efficiency to maintain a reasonable profit margin. Management has long recognized the thorough safety program as an important factor in achieving those objectives. Perhaps 1961 offers a new challenge for further improvement of the industry record on time, manpower, and money losses caused by on-the-job injuries.

The cost of accidents is well known by industrial management. Figures from the National Safety Council dramatically illustrate the size of those losses and the great opportunity for sizable savings. Example: The latest statistics show a total of 230 million mandays lost in 1959 because of work accidents. In the last decade, 2.75 billion mandays were lost. That is equivalent to shutting down every manufacturing plant in the nation for eight months.

In dollars, work accidents cost the industries in the U. S. about $4.2 billion in 1959. Half that amount was in visible costs, such as wages, medical expenses, and insurance. The other half was in damage to equipment and materials, production delays, and time lost by employees not involved in the accidents.

The job of safety progress will be done —as it has been in the past—by dedicated safety engineers working with enlightened management. But an important role can also be played by the manufacturer of safety equipment.

- He can provide knowhow and guidance in proper use of safety equipment.
- He can develop new equipment and provide new services that help the safety engineer do his job more economically and more efficiently.
- He can help overcome employee resistance to safety equipment by improving its comfort, quality, appearance, and over-all design.
- He can be alert to new hazards arising from advancing technology and suggest possible remedies.

Continuous Strip Detectors Offer Faster Fire Control

Walter E. Morgan Jr.—Still more applications in industry are expected for continuous strip fire detectors. They have been used around the engines of military and commercial aircraft for more than a decade. The strips, heat sensitive throughout their length, offer greater protection than was previously possible with industrial spot detectors.

They are being used to protect such industrial equipment as air preheaters and coal feed nozzles in powerplants, or gas generators and furnaces in the chemical and petrochemical industries. Applications are expected in heat exchangers, pipelines, kilns, refractory walls and

stacks, pebble bed heaters, catalytic bed type reactors, quench tanks, ducts, and filters.

The detectors give early warning of overheat before dangerous conditions develop. They are alert to generalized overtemperature throughout a zone and to localized hot spots. Warning of impending fire outbreak allows preventive action to be taken.

The detectors can be used with on-off type control equipment, or with recorders to provide continuous, visual monitoring of temperature conditions. They are also excellent for use in systems that detect fire, sound an alarm, and operate automatic, fire extinguishing systems. Such use is especially important in automated, unmanned operations.

POLLUTION CONTROL

Progressive Plants Get Help From Dust Control Engineers

E. A. Carsey—Industrial expansion and anticipated development programs will be subjected to a close, hard look in 1961. Dust control, pneumatic handling, and allied systems will be carefully studied, evaluated, and improved where possible.

Industrial management will undoubtedly take advantage of the specialized engineering knowledge and techniques offered by the dust control industry. Maintenance and repair personnel will benefit, relieving them of such time consuming problems as design and installation.

General design trends are toward the use of higher line velocities, smaller diameter pipes, and closer study of the many applicable metals. Abrasion resistant steels and coated or protected metals will be used to prevent wear and corrosion.

Air replacement systems, long neglected, will receive more consideration. Smaller systems that offer production flexibility within department areas, seem to be gaining favor over the larger installations. Production costs, as always, will be given prime consideration in 1961, which promises to be highly competitive.

Demand for Precipitators Growing in Steel Industry

K. O. Shafer—Recent surveys indicate that steel industry applications of electrostatic precipitators are equaling the fly ash applications for public utilities. That trend will probably continue.

Precipitators have been installed in steel mills to clean gases from basic oxygen furnaces, open hearths, sinter plant windboxes, scarfing machines, blast furnaces, and coke ovens.

The steel industry is using an increasing number of precipitators on open hearths. One company is installing open hearth precipitators to clean 1.2 million cu ft per minute at one plant and facilities to clean gases at 950,000 cu ft a minute at another plant. If that trend continues, the steel industry will eventually represent more than 50 per cent of the electrostatic precipitator business.

Local air pollution codes are becoming more and more stringent; steel companies are attempting to clean up sources of air pollution.

Fabric Improvements Herald Filtering of Hotter Gases

W. O. Vedder—Rigid air pollution control regulations become increasingly numerous, especially for elevated temperature metallurgical problems. Progress has been made in the control of high temperature fumes and dust with fabric filters.

Many variables influence the design of air pollution control systems and equipment. Costly mistakes have been made when those factors were not considered. Each installation must be engineered to satisfy given conditions and requirements. The specialized nature of each problem should be recognized; individuals with extensive experience in dust and fume control should be consulted.

Improvements in the construction and treatment of filter fabrics, particularly those made of glass fiber materials, have resulted from operating experience. Several full scale installations have been developed with experience gained from pilot installations. Collection efficiencies of equipment that is properly designed and applied are well within specified requirements.

Filter cleaning methods (especially for glass fiber filters) are being improved to provide more effective cleaning and extended fabric life.

Self-Servicing Devices Gain In Air Pollution Control

Charles D. Wright—Requirements for air cleaning and control of dust and dirt in primary metal production are being defined within narrow limits, with emphasis on equipment that requires minimum maintenance or is self-servicing. Devices with extraordinary performance and maintenance features are available.

Metalworking managers are investigating the adoption of plant-wide air conditioning to a greater extent than ever before in designing new assembly and finishing facilities. Requirements for air cleaning in such facilities vary from the minimum, where filters are needed only to prevent heavy accumulations of dirt in the general ventilation system, to the highly sensitive and exacting needs of precision assembly areas, where filters must remove extremely small particles of dust and dirt. With that range of requirements, it is increasingly evident that successful, minimum cost

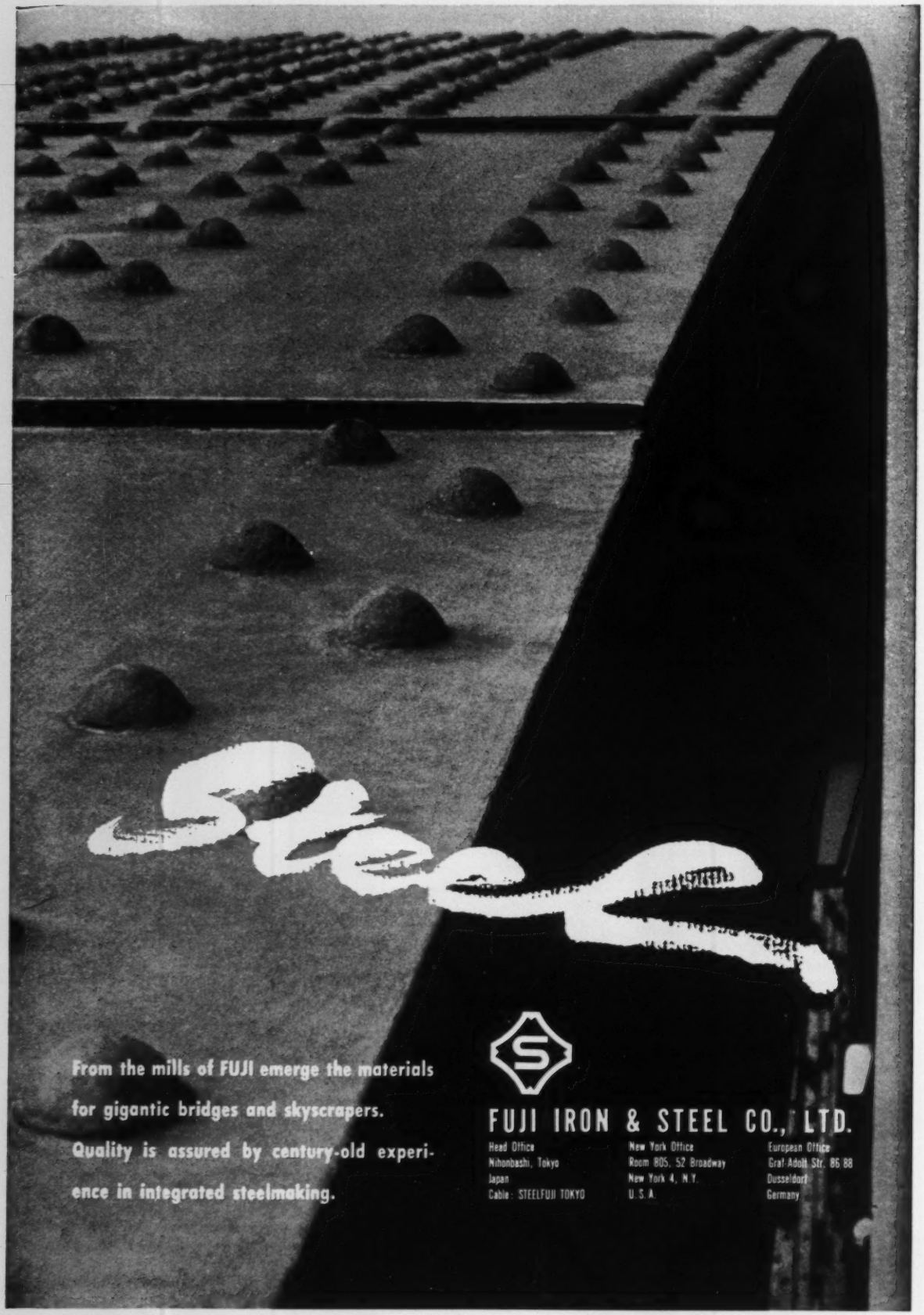
(*Please turn to Page 262*)

Service and Maintenance

K. O. SHAFER
Sales Engineer
Research-Cottrell Inc.
Bound Brook, N. J.

W. O. VEDDER
Vice President
Pangborn Corp.
Hagerstown, Md.

CHARLES D. WRIGHT
Supervising Engineer
American Air Filter Co. Inc.
Louisville



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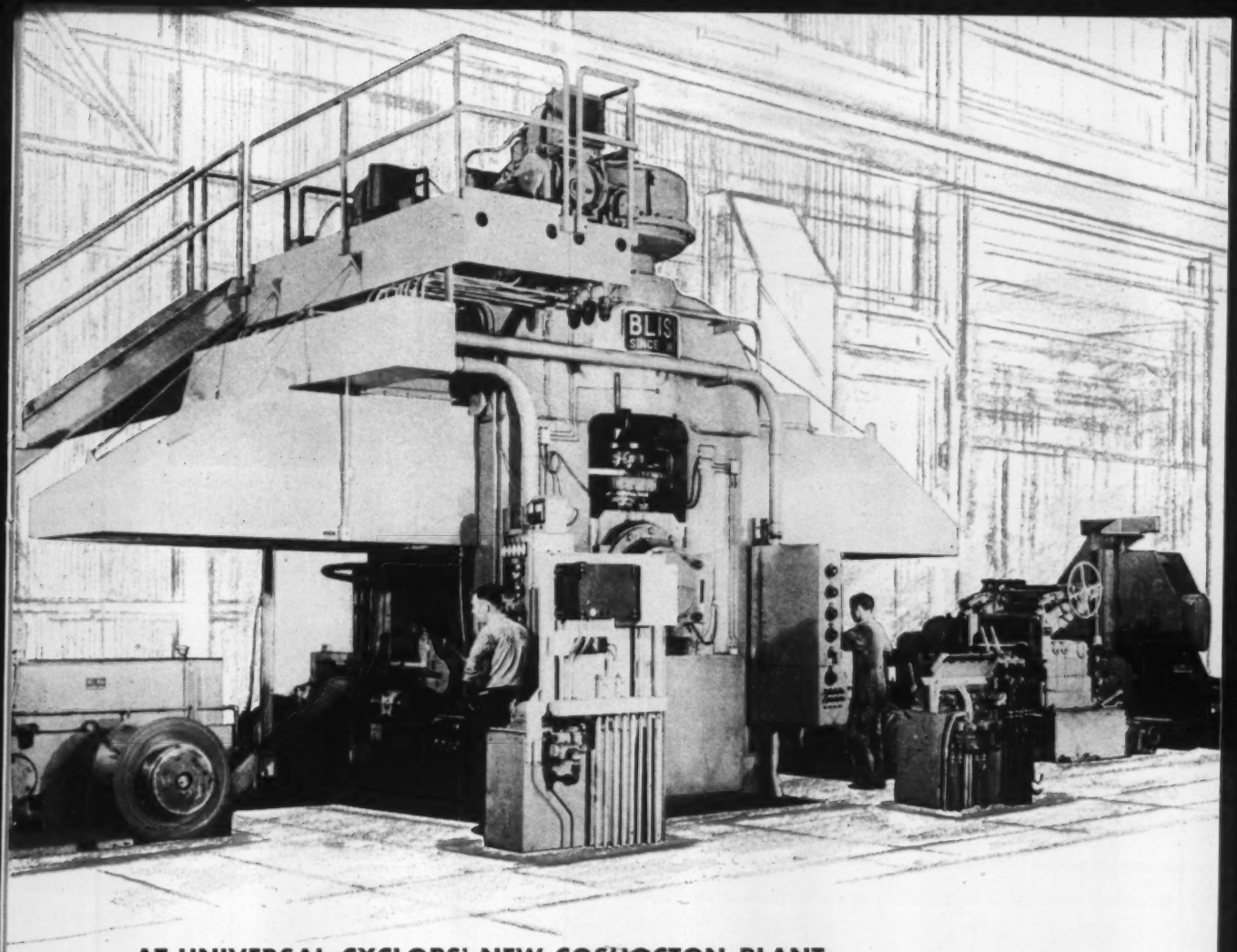


AT UNIVERSAL-CYCLOPS' NEW COSHOCTON PLANT:

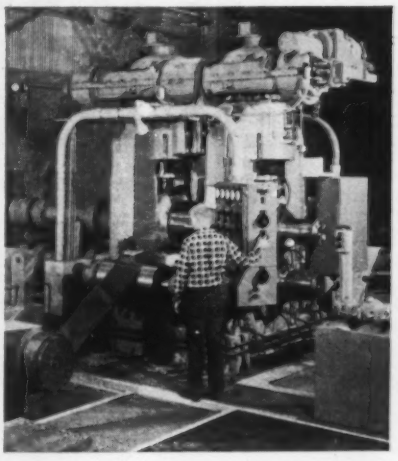
Stainless gets a fine finish fast

All the rolling at Universal-Cyclops Steel Corporation's new stainless strip finishing plant at Coshocton, Ohio, is accomplished on two rolling mills designed and built by Bliss' Rolling Mill Division. Steels rolled include all standard AISI grades in widths up to 24 inches.

Workhorse of the two mills is the 4-high reversing mill shown above. It is ruggedly built to stand heavy rolling stresses developed at speeds as high as 1000 fpm. Auxiliary equipment includes a three-stop coil entry ramp, coil buggy and mandrel-type payoff reel, flattener and feed roll, tension reels and coil buggies.

The two-high Bliss temper mill (right) is used principally for straight chromium grades of stainless providing proper hardness and a lustrous finish to the strip. An unusual design feature is the absence of an entry guide box, eliminating a source of dirt accumulation and strip scratching.

These two mills at Universal-Cyclops are typical of the modern approach to rolling mill design you'll find at Bliss. For other examples of our work, write us today for your complimentary copy of the 84-page Bliss Rolling Mill Brochure, Bulletin 40-B.



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SINCE 1857

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E. W. BLISS COMPANY, Rolling Mill Division, Salem, Ohio

Subsidiary: The Matteson Equipment Company, Inc., Poland, Ohio

The PERFECT FIT!

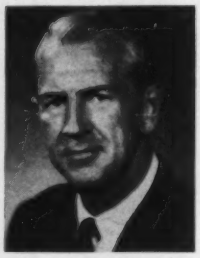
"Job-Mated" cranes by Shepard Niles fit the job picture perfectly because each one is built to meet exact on-the-job conditions. The ideal combination of capacity, clearance, speed and controls is specified to assure years of highly efficient, economical service, and to keep wear and maintenance to a minimum.

With the most complete line of quality-built cranes in America to choose from, you can be sure you have the **right** crane for the job—a **"Job-Mated"** crane by Shepard Niles—from 500 lbs. to 500 tons.

For further information on Shepard Niles cranes, and how they can improve your plant operation, write for a descriptive bulletin, and ask to have a Shepard Niles representative call at your convenience.

SHEPARD NILES
CRANE AND HOIST CORPORATION
2306 Schuyler Ave., Montour Falls, N.Y., U.S.A.

Service and Maintenance



ORVILLE C. HOGNANDER
Senior Vice President
G. H. Tennant Co.
Minneapolis

(*Continued from Page 259*)

operation of air cleaners and ventilation systems depends on air filter selection. Complete evaluation of air filtering equipment must take into account the long term cost of owning and operating and the ability of devices to give required results with a minimum of inspection and service.

Plant-wide air conditioning imposes severe requirements for the collection of room generated dust and dirt. Economic factors of total air conditioning require dust collection and air recirculation in many areas where simple exhaust was previously considered adequate.

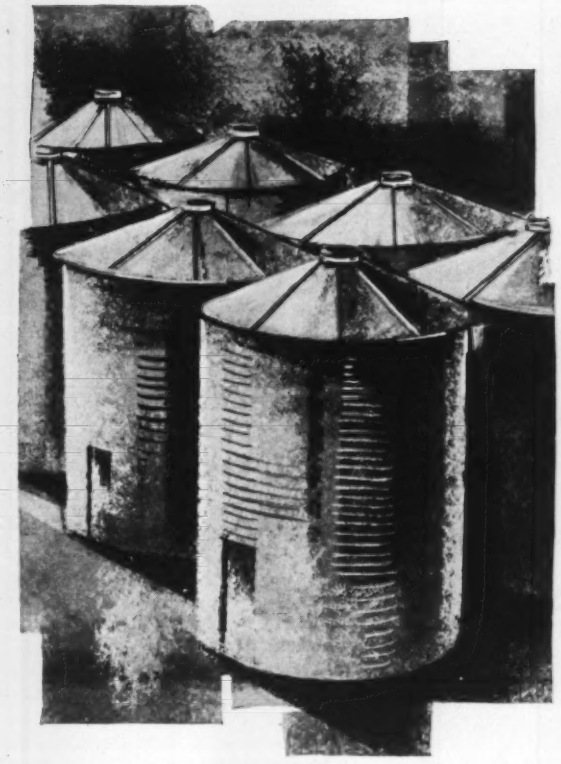
Suppliers of air filters and dust control equipment are prepared to meet foreseeable needs in all areas of metalworking, from mining to product finishing. New approaches to old problems and new equipment for special applications are under constant investigation.

MACHINERY

Floorsweeper's Productivity Boosted with Better Machines

Orville C. Hognander—Fatigue easing features will figure prominently on floor cleaning machines in 1961. That will mean greater productivity from floor cleaning personnel—lower cost per square foot—and generally improved morale.

Example: A typical, cylinder type, 16 in., floor cleaning machine (a husky old warhorse introduced in 1945 for removing grease-caked dirt from factory floors) was pushed back and forth by hand last year. This year, the completely redesigned machine propels itself forward or in reverse;



New steels are born at Armco

from bins to bikes . . .

Sheffield has the right bolts

Sheffield bolts do a better fastening job in thousands of products and applications, ranging from huge grain bins to backyard bike repairs.

Why? Because every Sheffield bolt is a precision product, made to fine tolerances and quality controlled from furnace to finished bolt. Sheffield's bolt plant is one of the world's largest. It's staffed by a team of metallurgists, engineers and research experts who specialize in bolts.

These are some of the reasons why you'll get the right bolts from Sheffield, and get them right on time. Whether your needs are for standard bolts, special bolts or bolt products made to your specifications, get in touch with your Sheffield Man.

SHEFFIELD
ARMCO

BOLT PRODUCTS

SHEFFIELD DIVISION

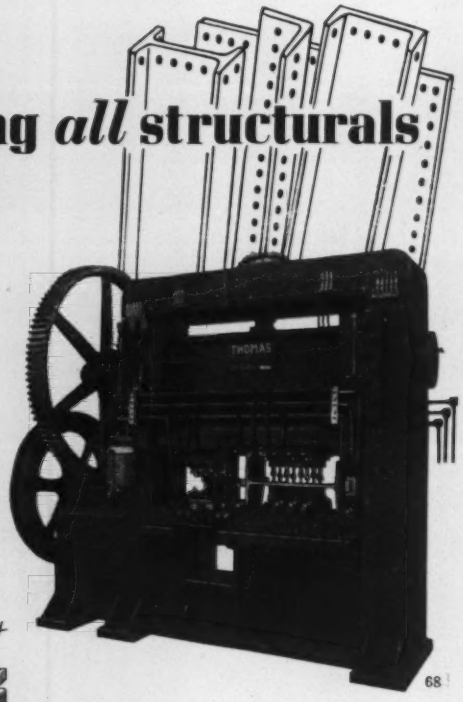
Sheffield Plants in Kansas City, Tulsa and Houston

ARMCO

ARMCO STEEL CORPORATION

OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

for punching *all* structurals *and* plates



These Thomas All-Steel Multiple Punches will handle beams, angles, channels *and* wide plates. Offered in 150-, 225- and 300-ton sizes, they will accommodate beams from 3" to 36" WF and plates up to 72" with minimum changing of tools.

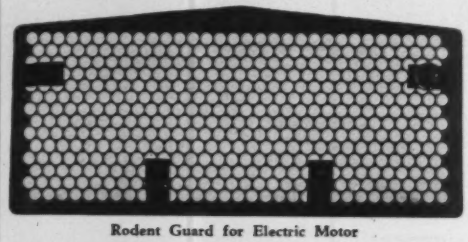
The trend is to Thomas

THOMAS
MACHINE MANUFACTURING CO.
PITTSBURGH 23, PA.

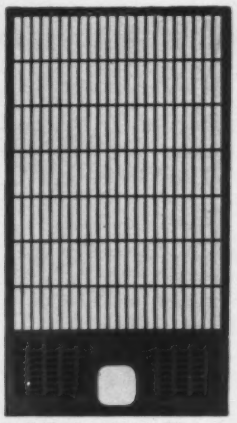
68

Write for detailed information on the size to meet your needs, either with or without a Thomas Spacing Table.

PUNCHES • SHEARS • PRESSES • BENDERS • SPACING TABLES



Rodent Guard for Electric Motor



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by letting
"DIAMOND" DO IT

For nearly half a century we have been furnishing perforated metal sheets, plates and parts to manufacturers of industrial equipment and household appliances, at lower cost than if the work were done in their own shops. No magic — just because we are especially equipped and organized for that type of work.

Let us quote on YOUR requirements. When given sufficient information, our experienced engineers are often able to make money-saving suggestions and always welcome an opportunity to do so.

Our new 32-page catalog illustrates a great variety of perforated metal patterns and gives complete working data. Also shows many modern applications. Write for Catalog 59. No charge or obligation.

DIAMOND MANUFACTURING CO., WYOMING (Wilkes-Barre Area) PENNA.

Manufacturers of DIAMOND Perforated Metal Panels for Modern Acoustical Ceilings.

Service and Maintenance

TERENCE CAFFREY
Chief Engineer
Davey Compressor Co.
Kent, Ohio

the operator merely guides it. Other improvements: More efficient vacuum system, increased horsepower, more safety devices, and better soilage pickup capacity.

The machine is used mostly in narrow, congested aisles; it illustrates trends in mechanization, even for walk behind, floor cleaning machines. Previously, complete self-propulsion was limited mostly to riding machines used in main aisles.

Power sweepers will also show marked improvement in 1961. Major changes will include increased power and capacity for heavy duty work in foundries. Larger sweepers will have integral soilage pickup and dust control, pull through vacuum systems, power agitated filters, and larger capacity hoppers.

Another important development: Introduction of the "system" approach to floor maintenance. The plant will plan its floor care program as a complete unit, instead of in isolated segments. Techniques, materials, and machines will be adopted on a selective, scientific basis, for plant-wide efficiency, economy, and safety.

Rotary Type Air Compressor Reduces Maintenance Problems

Terence Caffrey—Air compressor developments in the last few years have produced a machine ideally suited to industrial needs—the oil flooded, rotary compressor. It compresses air efficiently but eliminates many of the maintenance requirements of other machines. It has no piston rings or intake and discharge valves, so it requires none of the service associated with those items.

Delivered air is extremely free of oil, because entrained oil is removed from the air before it leaves the machine by an

Service and Maintenance

H. W. RAINEY
Marketing Manager, Sturtevant Div.
Westinghouse Electric Corp.
Boston

efficient separatory system. Air temperature doesn't exceed 200° F during compression; oil that is carried over is not carbonized or modified in any way. That eliminates the fouling of air lines in the plant with carbon and varnish, which would reduce the line capacity and possibly cause explosions.

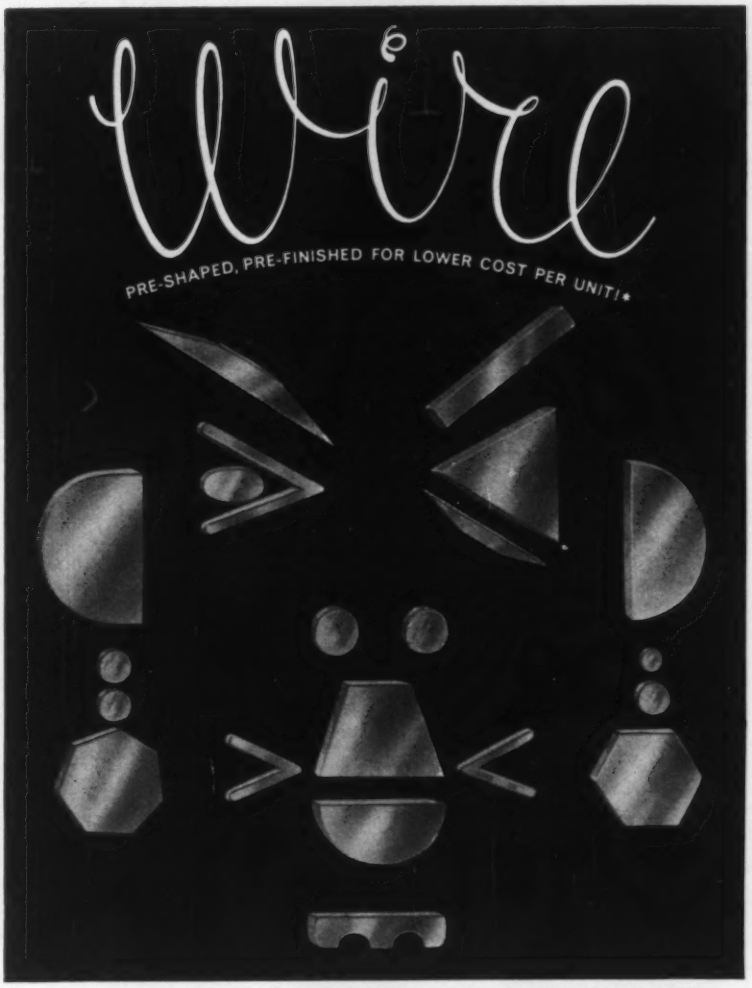
The machine is virtually vibrationless and has a low noise level. That allows it to be placed anywhere in a plant without causing discomfort to nearby personnel. It is small; it offers further savings in floor space by having no external moving parts that have to be guarded.

Industrial Designers Use 'Compact' Concept

H. W. Rainey—The trend toward the compact is not confined to the auto industry. For example, manufacturers of heating, ventilating, air conditioning, and air cleaning equipment are constantly aware of the customer's need for equal or better performance in less space.

It is smart business for the metalworking manufacturer to analyze his products from the space saving viewpoint. In 1960, for instance, our company introduced a fan that gives the same performance as bulkier equipment but takes only half the space. We hope to concentrate on space saving in other products introduced in 1961.

In planning products to save space, we often find that old ideas can be combined successfully with up-to-date technology. An idea that wasn't practical some years ago because of the state of technology at that time can often be re-engineered.



*Examples shown are greatly enlarged cross-sectional views of selected standard and special shapes available

The right shape plus the right finish equals lower production costs

with CONTINENTAL® round and special shaped wire

Face up to the pleasant fact that you can often shave your production costs appreciably—and win extra sales—by choosing the right shape in wire. You save because you eliminate forging, stamping, rolling or machining operations. What's more, you can get these ready-made shapes (and many others than shown) in bright, galvanized, coppered, liquored, or tinned finishes that save further in polishing and plating. If you use low and medium low carbon steel wire in any shape, form or finish, by all means learn what Continental can offer you. We have solved literally thousands of problems involving wire. We'd love to have a shot at solving yours.

Write for free copy of our new wire manual

CONTINENTAL STEEL
CORPORATION KOKOMO, INDIANA

PRODUCERS OF: Manufacturer's Wire in many sizes, tempers, and finishes, including Galvanized, KOKOTE, Flame Sealed, Coppered, Tinned, Annealed, Liquor-Finished, Bright and special shaped wire. Also Welded Wire Reinforcing and Galvanized Fabric, Nails, Continental Chain Link Fence, and other products.

15 Proofs of SANDVIK SPRING STEEL QUALITY

For up to 40 years Sandvik Specialty Steels have been used successfully for —

1. Compressor Valves
2. Band Saws
3. Piston Ring Springs
4. Conveyor Belts
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6. Feeler Gauges
7. Clock & Watch Springs
8. Vibrator Reeds
9. Shock Absorbers
10. Razor Blades
11. Surgical and Special Knives
12. A wide variety of Springs
13. Textile Machinery Sinkers, Needles, etc.
14. Camera Shutters
15. Masons Trowels

This list of exacting applications is the strongest proof of Sandvik steel's consistent quality. Over the years, these users have found that when product performance depends on *specific physical properties, high fatigue life, accurate and uniform flatness, straightness, gauge, width and finish,* Sandvik quality is well worth its price.

Ask your nearest Sandvik office for further information or technical assistance.

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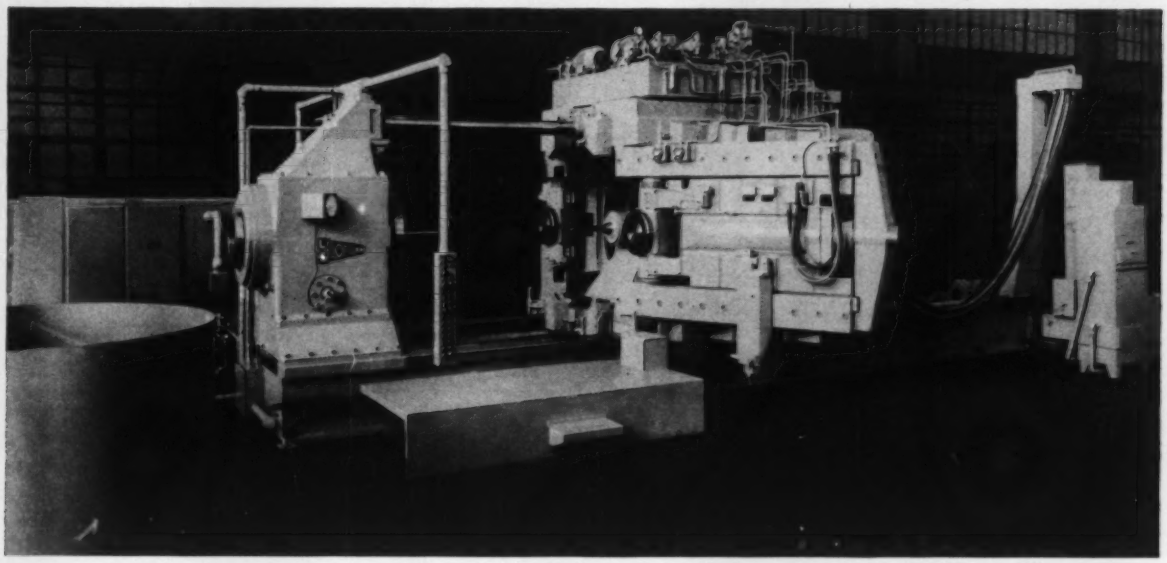
88-220

Flow Forming Unit Uses Two Rollers



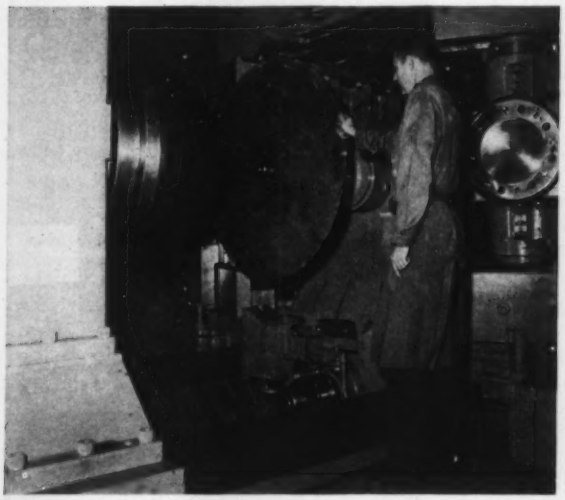
CONTOURED, conical, and cylindrical missile parts up to 70 in. in diameter and 84 in. long can be turned out on a Floturn shear forming unit designed for the Allison Div., General Motors Corp.

The machine (made by Lodge & Shipley, Cincinnati) can back flow cylinders up to a maximum length of 140 in. It can process flat or preformed blanks of steel, stainless steel, aluminum, or brass in a maximum thickness of 1¼ in.

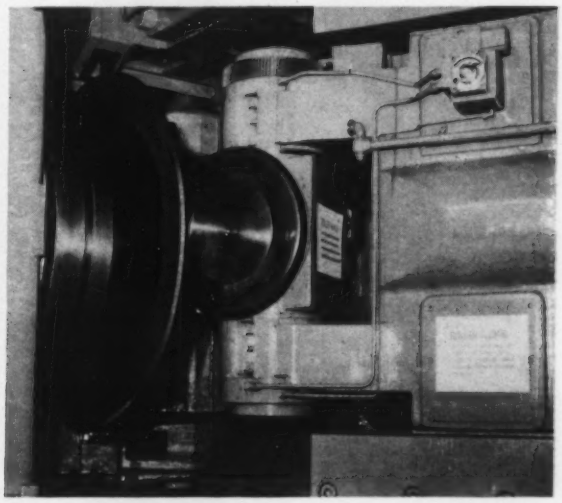
The unit is designed to reduce ¾ in. mild steel or ⅝ in. stainless 50 per cent in a single operation or pass.

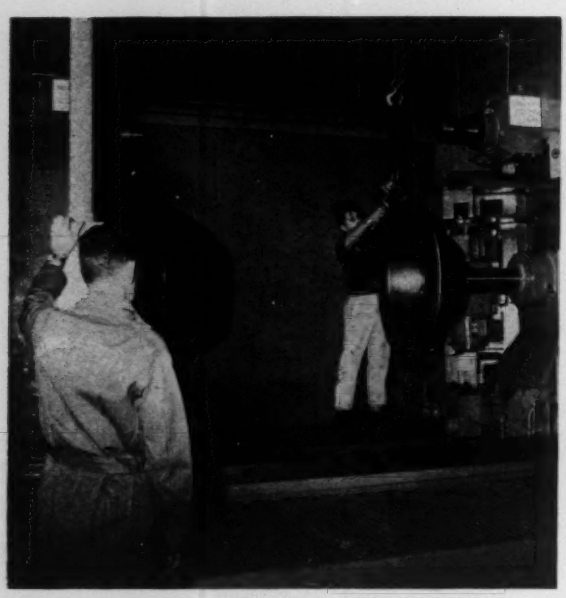
• With the Floturn process, Allison expects to get a raw material saving (via weight) of more than

. . . It handles 70 in. blanks of stainless, brass

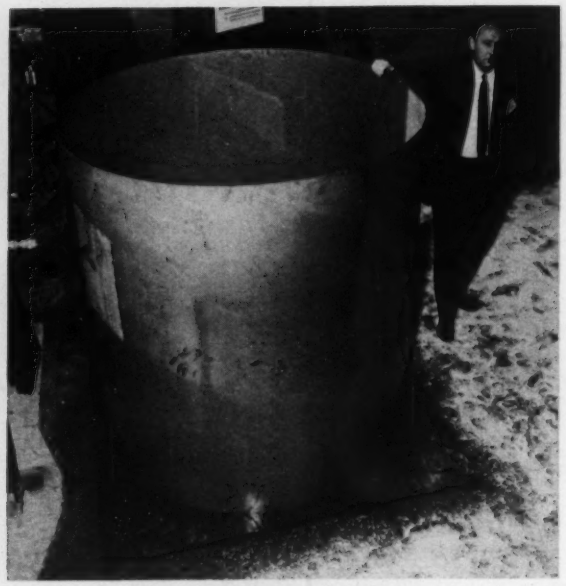


. . . At high rates of feed and material reduction





Work is stripped hydraulically from mandrel



Long cylinders can be formed

50 per cent and savings in machining time of more than 80 per cent.

The company says the process permits cutting the number of forgings used in a missile case from four, 48 in. long cylinders to three, 28 in. long cylinders. A girth weld is eliminated, and the flowing process reduces the wall thickness to the proper dimension without machining. A bonus: The strength and hardness of the formed part are built up.

• The unit has two opposing roller slides connected by a special crown.

Allison says the dual roller design permits heavy feed rates and high material reduction. Each independently controlled and synchronized roller slide can exert a force of 70,000 lb on the workpiece. Each roller is equipped with an overriding hydraulic motor that brings the roller up to operating speed before it contacts the blank. Correct roller speed helps prevent scuffing and irregularities in the work surface. It also prevents damage to the forming roller. The roller heads provide for the mounting of 20 in. (diameter) roller rings of various shapes.

• Hydraulic Tracers control the in and out movement of the two roller slides.

Tracing styluses follow templates. Each Tracer system has an individual hydraulic pump and motor.

Separate template supports are provided on each side of the machine bed. A micrometer adjustment permits positioning the templates in three directions. Templates and supports are protected from damage or dirt.

• The tailstock has a live center that holds the blank on the mandrel during the flowing operation.

A yielding tailstock provides a smooth and continuous carriage feed during the entire operation. For back flowing operations involving parts longer than 84 in., the tailstock can be removed to permit cylindrical workpieces to flow beyond the tailstock end of the machine.

• The bed is a casting about 34 ft long by 7 ft wide.

The bed does not take any load from the feed of the machine (it's absorbed by the feed rods). The torsional load from work rotation is absorbed. The bed also supports the headstock, guides the machine carriage, provides a rigid template mounting, and serves as a reservoir for the coolant system.

• All hydraulic equipment is mounted on top of the carriage to minimize hose requirements.

Each function has a separate pump and motor. All draw from a common reservoir built into the top of the carriage.

The work stripper is hydraulically actuated and uses the feed cylinders as a power source.

For further information, *write* Lodge & Shipley, 3055 Colerain Ave., Cincinnati, Ohio.

Air Powered Unit Moves Pellets by Vibration

BULK QUANTITIES of pelleted metals can be moved by a totally enclosed, air powered, vibrating conveyor that eliminates dust and contamination problems.

Even the most brittle materials can be carried without chipping or breaking, says the company. Flow is started and stopped by a quick acting valve and can be regulated by adjusting the air supply pressure.

Four coil springs provide support and isolate vibration from surrounding structures. The unit can be cleaned with common cleaners without damage to the conveyor or vibratory unit.

For further information, *write* Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13, Ohio.

LINDE COMPANY

UNION CARBIDE

UNIONARC

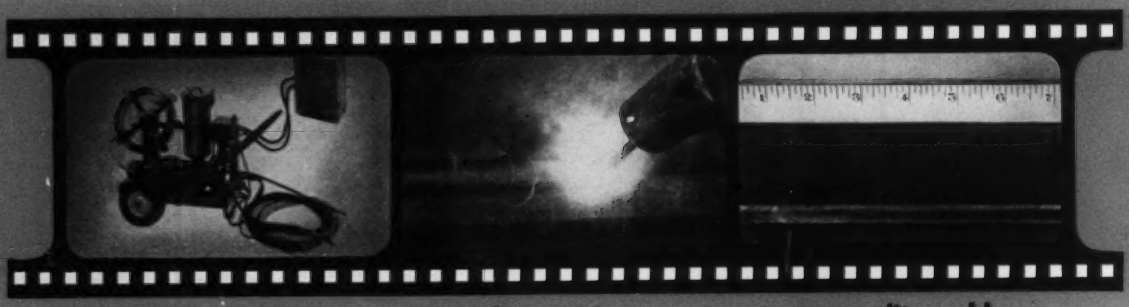
REDESIGNED...REBUILT...RELIABLE

Development of a LINDE welding process does not stop with its introduction. In the past 18 months, we have invested over 3000 laboratory manhours to further improve the UNIONARC welding process and equipment. New: portable UAM-2 machine, simplified UAW-2 torch, refined consumables. Improved equipment for an improved CO_2 steel welding process, featuring

- **...wear-resistant flux and wire-guide tubes, super-hard "Stellite" torch body**
- **...automatic flux-CO_2 shutoff valve for precise flow of consumables**
- **...stainless-steel hopper funnel for smooth flux feed**
- **...serrated V-groove drive roll (patent pending) for positive wire feed**
- **...miniature machine—300 lbs. lighter, uses 50% less space**
- **...refined flux that increases metal deposition rates**
- **...proven results: dependable operation with minimum maintenance.**

For field-tested application details, see next page

UNIONARC



Portable machine... produces 30-ipm... top-quality welds

One of the nation's largest construction-equipment manufacturers field-tested 15 UNIONARC UAM-2 machines full time—three shifts a day, six days a week—over 2000 hours per week. Maintenance has averaged less than ½ hour per machine per week, a downtime factor of less than 0.5 per cent. This is tested reliability that insures process advantages:

...cost as low as 27¢/lb. of metal deposited
...deposition rates as high as 25 lb./hour
...speed over 30 ipm on ¼ in. carbon-steel fillets
...quality to strictest specifications—ASME, Military, Bureau of Shipping
...full penetration requiring less preparation, fewer passes, less wire.

On a production basis, these advantages mean substantial savings. A western pipe manufacturer saved 25¢/ft. of weld on 28,000 feet of welds. A southwestern fabricator reduced welding time on three on-site storage tanks (9500 ft. of welds) from 1850 manhours to only 700 manhours. A northern manufacturer eliminated expensive reworking of code assemblies, gained 100% weld acceptance with UNIONARC compared to 50% to 90% with covered electrodes. A mid-western manufacturer eliminated beveling, and reduced pass and wire requirements on Schedule 40 pipe by 2:1 and 8:1 ratios respectively.

UNIONARC welding is an ideal process for carbon steel. On a production basis, it is unquestionably faster and more economical than other CO_2 or covered electrode processes. It uses a wide range of readily-available, low-cost wires that meet any application need. It uses one flux, one low-cost CO_2 shielding gas. It has the speed and weld quality of manual submerged-arc welding, with the advantage of weld visibility. It is a sound, well-engineered process designed primarily for repetitive, high-production work on carbon steel. For these applications, the new UNIONARC UAM-2 machine offers outstanding cost advantages with a field-proven low-maintenance factor that produces clear-cut profit for its user. For detailed information or a live demonstration, call your nearest LINDE office.

"Linde," "Unionarc" and "Union Carbide" are registered trade marks of Union Carbide Corporation

LINDE COMPANY

UNION CARBIDE

Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

1961 Calendar of Meetings

JANUARY

Jan. 8-11, Institute of Scrap Iron & Steel Inc.: Annual meeting, Fontainebleau and Eden Roc Hotels, Miami Beach, Fla. Institute's address: 1729 H St. N.W., Washington 6, D. C. Assistant executive vice president: William S. Story.

Jan. 9-11, Twenty-second Annual Mining Symposium: Norshor Theater, Duluth; headquarters at Hotel Duluth. Sponsored by University of Minnesota in co-operation with Minnesota Chapter of AIME&ME. Information: University of Minnesota, Center for Continuation Study, Minneapolis 14, Minn.

Jan. 9-13, Society of Automotive Engineers Inc.: International congress and exposition, Cobo Hall, Detroit. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: Joseph Gilbert.

Jan. 10, Hoist Manufacturers Association: Annual meeting, Statler-Hilton Hotel, Cleveland. Association's address: 1 Thomas Circle, Washington 5, D. C. Executive secretary: J. H. Peritz.

Jan. 17-19, Instrument Society of America: Winter instrument-automation conference and exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis. Society's address: 313 Sixth Ave., Pittsburgh 22, Pa. Executive director: William H. Kushnick.

Jan. 18, Metallurgical Society of AIME: Third AIME mechanical working conference, Penn-Sheraton Hotel, Pittsburgh. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: R. W. Shearman.

Jan. 18, Steel Plate Fabricators Association: Annual meeting, Lago Mar Hotel, Ft. Lauderdale, Fla. Association's address: 105 W. Madison St., Chicago 2, Ill. Secretary: J. Dwight Evans.

Jan. 19, Engineers Joint Council: Annual meeting, Biltmore Hotel, New York. Council's address: 29 W. 39th St., New York 18, N. Y. Secretary: L. K. Wheelock.

Jan. 19-21, Southern Industrial Distributors Association: Midyear meeting, Palm Beach Biltmore Hotel, Palm Beach, Fla. Association's address: 1626 Fulton National Bank Bldg., Atlanta 3, Ga. Secretary-treasurer: E. L. Pugh.

Jan. 23-24, Industrial Heating Equipment Association Inc.: Winter meeting, Dearborn Inn, Dearborn, Mich. Association's address: Association Bldg., Washington 6, D. C. Executive vice president: Robert E. Fleming.

Jan. 23-26, Plant Maintenance Show: International Amphitheatre, Chicago. Information: Clapp & Poliak Inc., 341 Madison Ave., New York 17, N. Y.

Jan. 30-Feb. 3, American Society for Testing Materials: Committee week, Netherland-Hilton Hotel, Cincinnati. Society's address: 1916 Race St., Philadelphia 3, Pa. Executive secretary: Thomas A. Marshall Jr.

Jan. 31, Steel Kitchen Cabinet Manufacturers Association: Annual meeting, Sheraton Towers Hotel, Chicago. Association's address: 910 Park Bldg., Cleveland 14, Ohio. Executive secretary: Sandford Curtiss.

FEBRUARY

Feb. 5-9, Associated Equipment Distributors: Annual convention and exhibit, Biltmore and Statler Hotels, Los Angeles. Distributors' address: 30 E. Cedar St., Chicago 11, Ill. Executive secretary: P. D. Hermann.

Feb. 10-12, American Electroplaters Society: Interim meeting, Statler-Hilton Hotel, Hartford, Conn. Society's address: 445 Broad St., Newark 2, N. J. Executive secretary: John P. Nichols.

Feb. 13-15, American Management Association: Personnel conference, Palmer House, Chicago. Association's address: 1515 Broadway, New York 36, N. Y.

Feb. 15-17, American Management Association: Marketing conference, Hotel Roosevelt, New York. Association's address: 1515 Broadway, New York 36, N. Y.

Feb. 16-17, National Industrial Conference Board Inc.: General session for all associates. Waldorf-Astoria Hotel, New York. Board's address: 460 Park Ave., New York 22, N. Y. Secretary: Herbert S. Briggs.

Feb. 20-22, American Management Association: General management conference, Hotel Olympic, Seattle. Association's address: 1515 Broadway, New York 36, N. Y.

Feb. 23, Cutting Tool Manufacturers Association: Annual meeting, Harmonie Club, Detroit. Association's address: 416 Penobscot Bldg., Detroit 26, Mich. Executive secretary: Martin J. Ewald.

Feb. 23-24, Alloy Casting Institute: Winter meeting, Boca Raton Hotel, Boca Raton, Fla. Institute's address: 1001 Franklin Ave., Garden City, N. Y. Executive vice president: E. A. Schoefer.

Feb. 26-Mar. 1, American Institute of Chemical Engineers: National meeting, Hotel Roosevelt, New Orleans. Institute's address: 25 W. 45th St., New York 36, N. Y. Secretary: F. J. Antwerpen.

Feb. 26-Mar. 2, Metallurgical Society of AIME: Annual meeting. Ambassador and Chase-Park Plaza Hotels, St. Louis. Society's address: 20 W. 39th St., New York 18, N. Y. Secretary: R. W. Shearman.

Feb. 27-Mar. 1, Association of Iron & Steel Engineers: Western meeting, Hotel Statler, Los Angeles. Association's address: 1010 Empire Bldg., Pittsburgh 22, Pa. Managing director: T. J. Ess.

MARCH

Mar. 1-2, Malleable Founders' Society: Technical and operating conference, Pick-Carter Hotel, Cleveland. Society's address: 781 Union Commerce Bldg., Cleveland 14, Ohio. Executive vice president: Lowell D. Ryan.

Mar. 5-8, American Road Builders Association: Annual convention and exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J. Association's address: 600 World Center Bldg., Washington 6, D. C. Executive vice president: L. W. Prentiss.

Mar. 5-9, American Society of Mechanical Engineers: Gas turbine power conference and exhibit, Shoreham Hotel, Washington. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

Mar. 11-15, National Association of Secondary Material Industries Inc.: Annual convention, Fairmont and Mark Hopkins Hotels, San Francisco. Association's address: 271 Madison Ave., New York 16, N. Y. Administrator: M. J. Mighdoll.

Mar. 13-14, Steel Founders' Society of America: Annual meeting, Drake Hotel, Chicago. Society's address: 606 Terminal Tower, Cleveland 13, Ohio. Executive vice president: F. Kermit Donaldson.

Mar. 13-17, Industrial Diamond Association Inc.: Annual meeting, Hollywood Beach Hotel, Hollywood, Fla. Association's address: 587A Newark-Pompton Turnpike, Box 175, Pompton Plains, N. J. Executive manager: Mrs. Margaret J. McGinnis.

Mar. 13-17, National Association of Corrosion Engineers: Annual convention

and exhibit, Statler-Hilton Hotel, Buffalo. Association's address: 1061 M&M Bldg., Houston 2, Tex. Executive secretary: T. J. Hull.

Mar. 13-17, Society of Automotive Engineers Inc.: National automobile meeting, Sheraton-Cadillac Hotel, Detroit. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: Joseph Gilbert.

Mar. 15-17, Electronic Industries Association: Committee meetings, Statler-Hilton Hotel, Washington. Association's address: 1721 DeSales St. N.W., Washington 6, D. C. Secretary: James D. Secrest.

Mar. 20-24, American Society for Metals: Western metal congress and exposition, Pan-Pacific Auditorium, Los Angeles. Society's address: Metals Park, Novelty, Ohio. Managing director: Allan Ray Putnam.

APRIL

Apr. 4-7, Society of Automotive Engineers: National aeronautic meeting and display, Hotel Commodore, New York. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: Joseph Gilbert.

Apr. 6-7, American Society of Mechanical Engineers: Management engineering conference (ASME-SAM), Statler-Hilton Hotel, New York. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

Apr. 10-11, American Society of Mechanical Engineers: Maintenance and plant engineering, Bancroft Hotel, Worcester, Mass. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

Apr. 10-12, Metallurgical Society of AIME: National open hearth steel conference and blast furnace, coke oven, and raw materials conference, Sheraton Hotel, Philadelphia. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: R. W. Shearman.

Apr. 11-14, Copper & Brass Warehouse Association: Annual meeting, Broadmoor Hotel, Colorado Springs, Colo. Association's address: 1900 Arch St., Philadelphia 3, Pa. Executive secretary: Thomas A. Fernley Jr.

Apr. 12-14, Metallurgical Society of AIME: International symposium on agglomeration, Sheraton Hotel, Philadelphia. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: R. W. Shearman.

Apr. 17-19, Fifth Conference on Manufacturing Automation: Cosponsored by Purdue University, Manufacturing Engineering Council, *Automation* Magazine. Place: Purdue University, Lafayette, Ind. Information: K. E. Glancy, Division of Adult Education, Purdue University, or *Automation*, Penton Bldg., Cleveland 13, Ohio.

Apr. 17-21, American Welding Society: Annual convention and exhibit, Commodore Hotel and Coliseum, New York. Society's address: 33 W. 39th St., New York 18, N. Y. National secretary: Fred L. Plummer.

Apr. 20-21, National Association of Sheet Metal Distributors: Spring meeting, Sheraton-Cleveland Hotel, Cleveland. Association's address: 1900 Arch St., Philadelphia 3, Pa. Executive secretary: Thomas A. Fernley Jr.

Apr. 23-27, American Ceramic Society Inc.: Annual meeting, Royal York Hotel, Toronto, Ont. Society's address: 4055 N. High St., Columbus 14, Ohio. General secretary: Charles S. Pearce.

Apr. 23-27, Scientific Apparatus Makers Association: Annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va. Association's address: 20 N. Wacker Dr., Chicago 6, Ill. Executive vice president: Kenneth Andersen.

Apr. 24-26, Association of Iron & Steel Engineers: Spring conference, Sheraton Hotel, St. Louis. Association's address: 1010 Empire Bldg., Pittsburgh 22, Pa. Managing director: T. J. Ess.

Apr. 24-27, Metal Powder Industries Federation: Annual meeting and show, Sheraton-Cleveland Hotel, Cleveland. Federation's address: 60 E. 42nd St., New York 17, N. Y. Executive secretary and treasurer: Kempton H. Roll.

Apr. 26-27, Metallurgical Society of AIME: Technical conference on high temperature materials, Pick-Carter Hotel, Cleveland. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: R. W. Shearman.

Apr. 30-May 3, National Screw Machine Products Association: Annual meeting, Somerset Hotel, Boston. Association's address: 2860 E. 130th St., Cleveland 20, Ohio. Executive vice president: Orrin B. Werntz.

MAY

May 1-2, American Zinc Institute Inc.: Joint annual meeting with Lead Industries Association, Drake Hotel, Chicago. Institute's address: 292 Madison Ave., New York 17, N. Y. Executive vice president: J. L. Kimberley.

May 7-11, American Society of Mechanical Engineers: Hydraulic Division conference, Queen Elizabeth Hotel, Montreal, Que. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

May 8-9, American Society of Mechanical Engineers: Lubrication symposium, Hotel Deauville, Miami Beach, Fla. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

May 8-12, American Foundrymen's Society: Annual convention and exhibit, Brooks Hall and Civic Auditorium, San Francisco. Society's address: Golf and Wolf Roads, Des Plaines, Ill. General manager: W. W. Maloney.

May 14-17, Copper & Brass Research Association: Annual convention and exhibit, Homestead Hotel, Hot Springs, Va. Association's address: 420 Lexington Ave., New York 17, N. Y. Managing director: Theodore E. Veltfort.

May 17-19, Society for Nondestructive Testing: Eastern regional convention, Sheraton-Mt. Royal, Montreal, Que. Society's address: 1109 Hinman Ave., Evanston, Ill. Secretary: Philip D. Johnson.

May 18-19, National Industrial Conference Board Inc.: General session for all associates on economics, Waldorf-Astoria Hotel, New York. Board's address: 460 Park Ave., New York 22, N. Y. Secretary: Herbert S. Briggs.

May 21-24, Industrial Heating Equipment Association Inc.: Spring meeting, Homestead Hotel, Hot Springs, Va. Association's address: Association Bldg., Washington 6, D. C. Executive vice president: Robert E. Fleming.

May 22-25, American Society of Mechanical Engineers: Design engineering conference and show, Cobo Hall, Detroit. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

May 22-26, American Society of Tool & Manufacturing Engineers: Annual convention and exhibit, Statler-Hilton Hotel, New York. Society's address: 10700 Puritan Ave., Detroit 38, Mich. Executive secretary: Harry E. Conrad.

May 24-25, American Iron & Steel Institute: Annual meeting, Waldorf-Astoria Hotel, New York. Institute's address: 150 E. 42nd St., New York 17, N. Y. Secretary: George S. Rose.

May 24-26, Electronic Industries Association: Annual convention, Pick-Congress Hotel, Chicago. Association's address: 1721 DeSales St. N.W., Washington 6, D. C. Secretary: James D. Secrest.

JUNE

June 4-7, National Association of Purchasing Agents: Annual meeting and exhibit, Conrad Hilton Hotel, Chicago. Association's address: 11 Park Place, New York 7, N. Y. Executive secretary: G. W. H. Ahl.

June 4-9, Society of Automotive Engineers: Summer meeting, Chase-Park Plaza Hotel, St. Louis. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: Joseph Gilbert.

June 5-7, American Society for Quality Control: Annual convention and exhibit, Sheraton Hotel, Philadelphia. Society's address: 161 W. Wisconsin Ave., Milwaukee 3, Wis. Administrative secretary: W. P. Youngclaus Jr.

June 5-9, Society of the Plastics Industry Inc.: National conference and show, Coliseum, New York. Society's address: 250 Park Ave., New York 17, N. Y. Executive vice president: William T. Cruse.

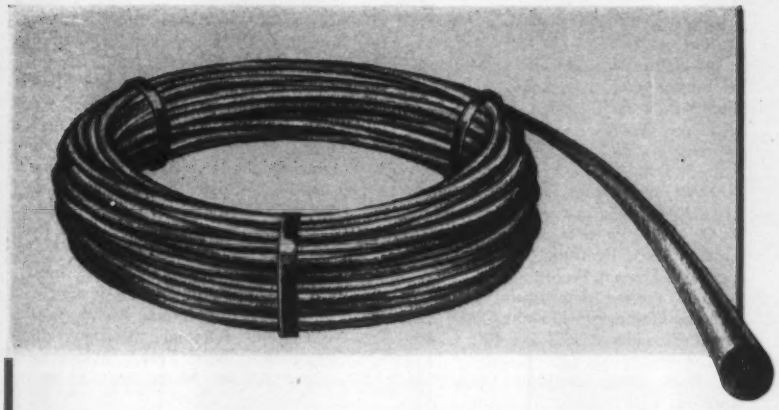
June 6-8, Instrument Society of America: Summer conference and exhibit, Toronto, Ont. Society's address: 313 Sixth Ave., Pittsburgh 22, Pa. Executive director: William H. Kushnick.

June 8-9, Malleable Founders' Society: Annual meeting, Broadmoor Hotel, Colorado Springs, Colo. Society's address: 781 Union Commerce Bldg., Cleveland 14, Ohio. Executive vice president: Lowell D. Ryan.

June 11-15, American Society of Mechanical Engineers: Summer annual meeting, Statler-Hilton Hotel, Los Angeles. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

June 12-15, National District Heating Association: Annual meeting, Wentworth-by-the-Sea, Portsmouth, N. H. Association's address: 827 N. Euclid Ave., Pittsburgh 6, Pa. Secretary-treasurer: John F. Collins Jr.

June 14-16, American Society of Mechanical Engineers: Applied mechanics con-



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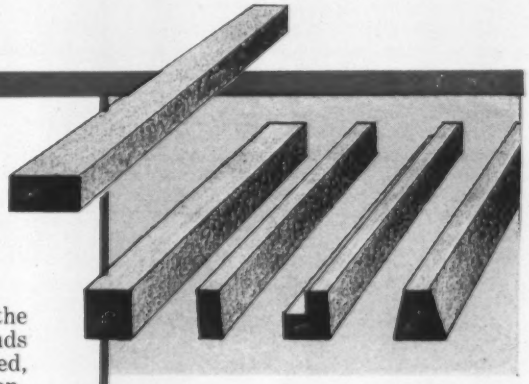

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ference, Illinois Institute of Technology, Chicago. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

June 14-17, Drop Forging Association: Annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va. Association's address: 1121 Illuminating Bldg., 55 Public Square, Cleveland 13, Ohio. Executive vice president: Dwight M. Allgood.

June 16-19, National Association of Metal Finishers: Annual meeting, Statler-Hilton Hotel, Boston. Association's address: 11 Park St., Montclair, N. J. Executive director: P. Peter Kovatis.

June 18-20, Alloy Casting Institute: Annual meeting, Homestead Hotel, Hot Springs, Va. Institute's address: 1001 Franklin Ave., Garden City, N. Y. Executive vice president: E. A. Schoefer.

June 18-23, American Electroplaters Society: Annual convention, Statler-Hilton Hotel, Boston. Society's address: 445 Broad St., Newark 2, N. J. Executive secretary: John P. Nichols.

June 19-21, American Marketing Association: Meeting and exhibit, Ambassador Hotel, Los Angeles. Association's address: 27 E. Monroe St., Chicago 3, Ill. Executive director: Vance E. Lockhart.

June 22-23, Refractories Institute: Annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va. Institute's address: 1801 First National Bank Bldg., Pittsburgh 22, Pa. Executive secretary: Avery C. Newton.

June 25-30, American Society for Testing Materials: Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Society's address: 1916 Race St., Philadelphia 3, Pa. Executive secretary: Thomas A. Marshall Jr.

June 26-27, American Vacuum Society: Fifth annual conference on vacuum metallurgy, jointly sponsored with New York University, University Heights Campus of NYU, New York. Society's address: Box 1282, Boston 9, Mass. Secretary: Harold C. Weingartner.

June 28-30, American Society of Mechanical Engineers: Joint automatic control conference, University of Colorado, Boulder, Colo. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

AUGUST

Aug. 16-19, Society of Automotive Engineers: National West Coast meeting, Sheraton Hotel, Portland, Oreg. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: Joseph Gilbert.

SEPTEMBER

Sept. 12, Instrument Society of America: Annual meeting in conjunction with fall conference and exhibit, Los Angeles. Society's address: 313 Sixth Ave., Pittsburgh 22, Pa. Executive director: William H. Kushnick.

Sept. 12-14, Electronic Industries Association: Committee and section meetings, Biltmore Hotel, New York. Association's address: 1721 DeSales St. N.W., Washington 6, D. C. Secretary: James D. Secrest.

Sept. 14-15, American Society of Mechanical Engineers: Engineering management conference (ASME-AIEE), Hotel Roosevelt, New York. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

Sept. 17-21, Nonferrous Founders' Society: Annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa. Society's address: 1604 Chicago Ave., Evanston, Ill. Executive secretary: Herbert Scobie.

Sept. 24-28, Pressed Metal Institute: Annual meeting, Grand Hotel, Point Clear, Ala. Institute's address: 3673 Lee Rd., Cleveland, Ohio.

Sept. 25-26, Steel Founders' Society of America: Fall meeting, Homestead Hotel, Hot Springs, Va. Society's address: 606 Terminal Tower, Cleveland 13, Ohio. Executive vice president: F. Kermit Donaldson.

Sept. 25-28, Association of Iron & Steel Engineers: Annual convention, Penn-Sheraton Hotel, Pittsburgh. Association's address: 1010 Empire Bldg., Pittsburgh 22, Pa. Managing director: T. J. Ess.

Sept. 27-28, American Die Casting Institute Inc.: Annual meeting, Edgewater Beach Hotel, Chicago. Institute's address: 366 Madison Ave., New York 17, N. Y. Secretary: David Laine.

OCTOBER

Oct. 1-5, Electrochemical Society Inc.: Fall meeting, Hotel Statler, Detroit. Society's address: 1860 Broadway, New York 23, N. Y. Executive secretary: Robert K. Shannon.

Oct. 4-6, American Machine Tool Distributors' Association: Annual meeting, Penn-Sheraton Hotel, Pittsburgh. Association's address: 1500 Massachusetts Ave. N.W., Washington 5, D. C. General manager: James C. Kelley.

Oct. 5-7, American Ceramic Society Inc.: Refractories Division, Bedford Springs Hotel, Bedford, Pa. Society's address: 4055 N. High St., Columbus 14, Ohio. General secretary: Charles S. Pearce.

Oct. 9-13, Society of Automotive Engineers: National aeronautic meeting and display, Ambassador Hotel, Los Angeles. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: Joseph Gilbert.

Oct. 10-12, National Electronics Conference Inc.: Annual convention and exhibit, Sherman Hotel, Chicago. Conference's address: 228 N. LaSalle St., Room 2104, Chicago, Ill. Executive secretary: R. J. Napolitan.

Oct. 18-20, Gray Iron Founders' Society Inc.: Annual meeting, Royal York Hotel, Toronto, Ont. Society's address: 930 National City-E. 6th Bldg., Cleveland 14, Ohio. Executive vice president: Donald H. Workman.

Oct. 18-20, Packaging Institute: 23rd annual forum, Biltmore Hotel, New York. Institute's address: 342 Madison Ave., New York 17, N. Y. Executive director: Charles A. Feld.

Oct. 19-21, Foundry Equipment Manufacturers Association Inc.: Annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va. Association's address: Suite 202, 1 Thomas Circle, Washington, D. C. Secretary: C. R. Heller.

Oct. 23-27, American Society for Metals: 43rd national metal congress and exposition, Cobo Hall, Detroit. Society's address: Metals Park, Novelty, Ohio. Managing director: Allan Ray Putnam.

Oct. 25-29, National Tool & Die Manufacturers Association: Annual meeting, Huntington-Sheraton Hotel, Pasadena, Calif. Association's address: 907 Public Square Bldg., Cleveland, Ohio. Executive vice president: George S. Eaton.

Oct. 31-Nov. 1, National Metal Trades Association: Biennial meeting, Hotel Commodore, New York. Association's address: 222 W. Adams St., Chicago 6, Ill. Secretary: Charles L. Blatchford.

NOVEMBER

Nov. 1-3, Investment Casting Institute: Annual meeting, North Park Hotel, Chicago. Institute's address: 27 E. Monroe St., Chicago 3, Ill. Executive director: H. P. Dolan.

Nov. 7-10, Packaging Machinery Manufacturers Institute: PMMI show of 1961, Cobo Hall, Detroit. Institute's address: 60 E. 42nd St., New York 17, N. Y. Executive director: Russell L. Sears.

Nov. 7-11, Automotive Parts Rebuilders Association: Annual convention and trade show, Hotel Biltmore, Los Angeles. Association's address: 220 S. State St., Chicago 4, Ill. Executive director: Nathan M. Roberts.

Nov. 16-17, National Foundry Association: Annual meeting, Savoy-Hilton Hotel, New York. Association's address: 4321 St. Charles Rd., Bellwood, Ill. Executive secretary: C. T. Sheehan.

Nov. 26, American Society of Mechanical Engineers: Winter annual meeting, Statler-Hilton Hotel, New York. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

Nov. 27-30, American Institute of Steel Construction Inc.: Annual convention, Boca Raton Hotel and Club, Boca Raton, Fla. Institute's address: 101 Park Ave., New York 17, N. Y.

Nov. 27-Dec. 1, Exposition of Chemical Industries: Biennial convention and exhibit, Coliseum, New York. Information: International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

Nov. 28-30, Electronic Industries Association: Committee and section meetings, Statler-Hilton Hotel, Los Angeles. Association's address: 1721 DeSales St. N.W., Washington 6, D. C. Secretary: James D. Secrest.

Dec. 3-6, American Institute of Chemical Engineers: 54th annual meeting, Hotel Commodore, New York. Institute's address: 25 W. 45th St., New York 36, N. Y. Secretary: F. J. Antwerpen.

DECEMBER

Dec. 6-8, Metallurgical Society of AIME: 19th electric furnace conference, Penn-Sheraton Hotel, Pittsburgh. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: R. W. Shearman.

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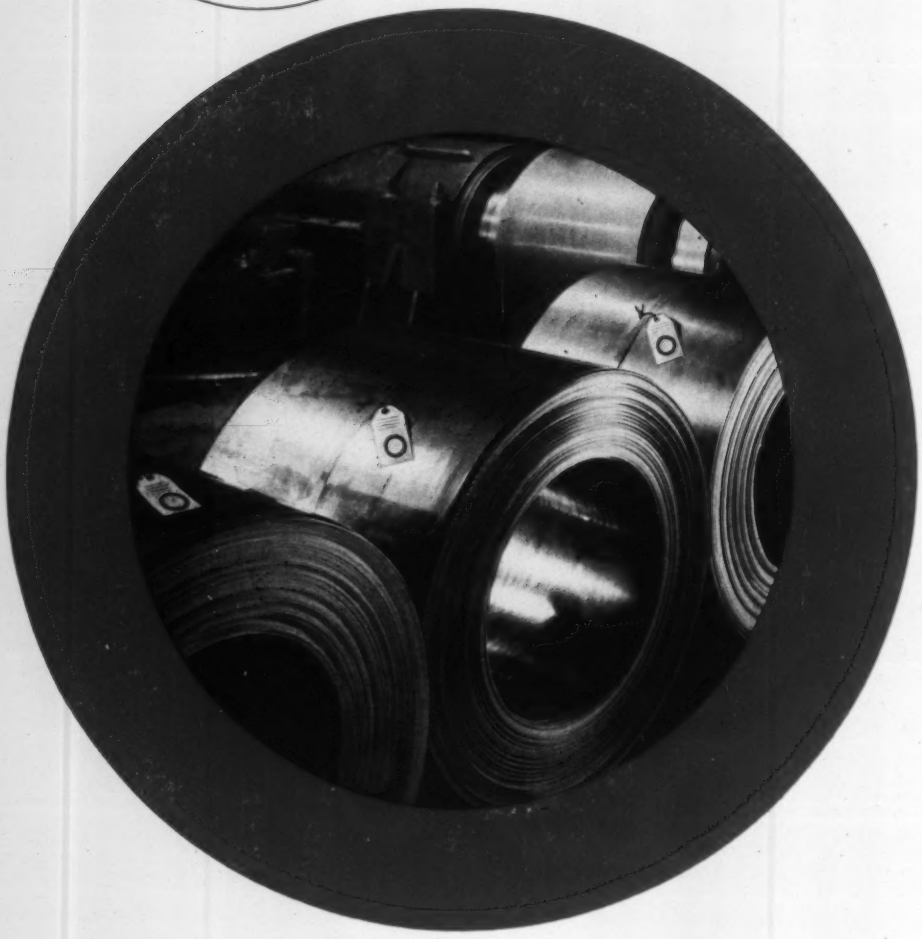

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Steel Outlook: Gradual Upturn

STEELMAKERS will take a different route this year—upward instead of downward—but chances are they'll get to the same destination they reached in 1960.

Production will probably be close to last year's 99.3 million ingot tons. It will be slightly less than the average for the last ten years (102 million). In 1958, the most recent offyear for the economy, steel output fell to 85.3 million tons. In 1954, it dropped to 88.3 million.

The reason production won't drop so much this time is that consumer inventories are close to rock bottom—the lowest in a decade.

DURABLES LOOK SOFT— Although auto and appliance manufacturers are radiating confidence for 1961, most economists predict that: 1. Auto assemblies will drop into the 5.8 million to 6.3 million bracket (from last year's 6.7 million). 2. Appliance output won't be much higher than it was in 1960. Since the automotive industry is steel's biggest market (it takes about 20 per cent of the tonnage that is shipped annually), even a small drop in car production can cause the mills considerable distress. The trouble is compounded when there's a general decline in spending for plant and equipment, and that's what the economists foresee.

CANS, CONSTRUCTION UP— But the picture isn't entirely bleak. Market analysts expect greater activity in at least two areas—containers (which take about 9 per cent of annual steel shipments) and nonresidential construction. Last year was a poor one for cans because of bad weather, smaller food packs, and increasing competition from plastic, glass, and aluminum containers.

PIPE SHIPMENTS TO GAIN— Even in markets where steel consumption isn't likely to increase, there may be a need for bigger steel shipments. Take oil country goods. Drilling activity will probably be no greater than it was in 1960, but consumer inventories are much lower than a year ago, so mill shipments may be as high as 1.5 million tons (vs. 1.2 million tons last year).

OUTLOOK BY QUARTERS— As inventory liquidation tapers off during the first quarter, steel production will rise to meet consumption—but consumption will stay at a low level until the weather improves and construction picks up. Automotive output will be less than it was in the fourth quarter (probably 1.5 million cars vs. 1.75 million), and canmakers will keep tight control of their inventories.

The second and third quarters will follow normal seasonal patterns—the second up moderately as construction and canning accelerate, the third off somewhat because of vacations in metalworking plants and auto model changeovers.

The fourth quarter should be the best of the year—partly for seasonal reasons and partly because of a general upswing in the economy. Automakers and appliance firms will be in volume production of their 1962 models, and housing starts will probably be at a peak. If steel buyers start worrying about another industry strike in mid-1962, when the present contract expires, they may start to replenish their stocks. A widespread shift toward inventory accumulation could boost fourth quarter steel output substantially and push the year's production well above 100 million ingot tons.

HIGHER PRICES— A moderate price hike is almost a certainty this year, in view of the higher employment costs that steelmakers have had to absorb and the resultant shrinkage of profits. Most observers think a move will be made either in the second quarter, when market conditions are more favorable, or in October, when the steelworkers get another wage increase.

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*Current prices were published in the Dec. 26 issue and will appear in subsequent issues.

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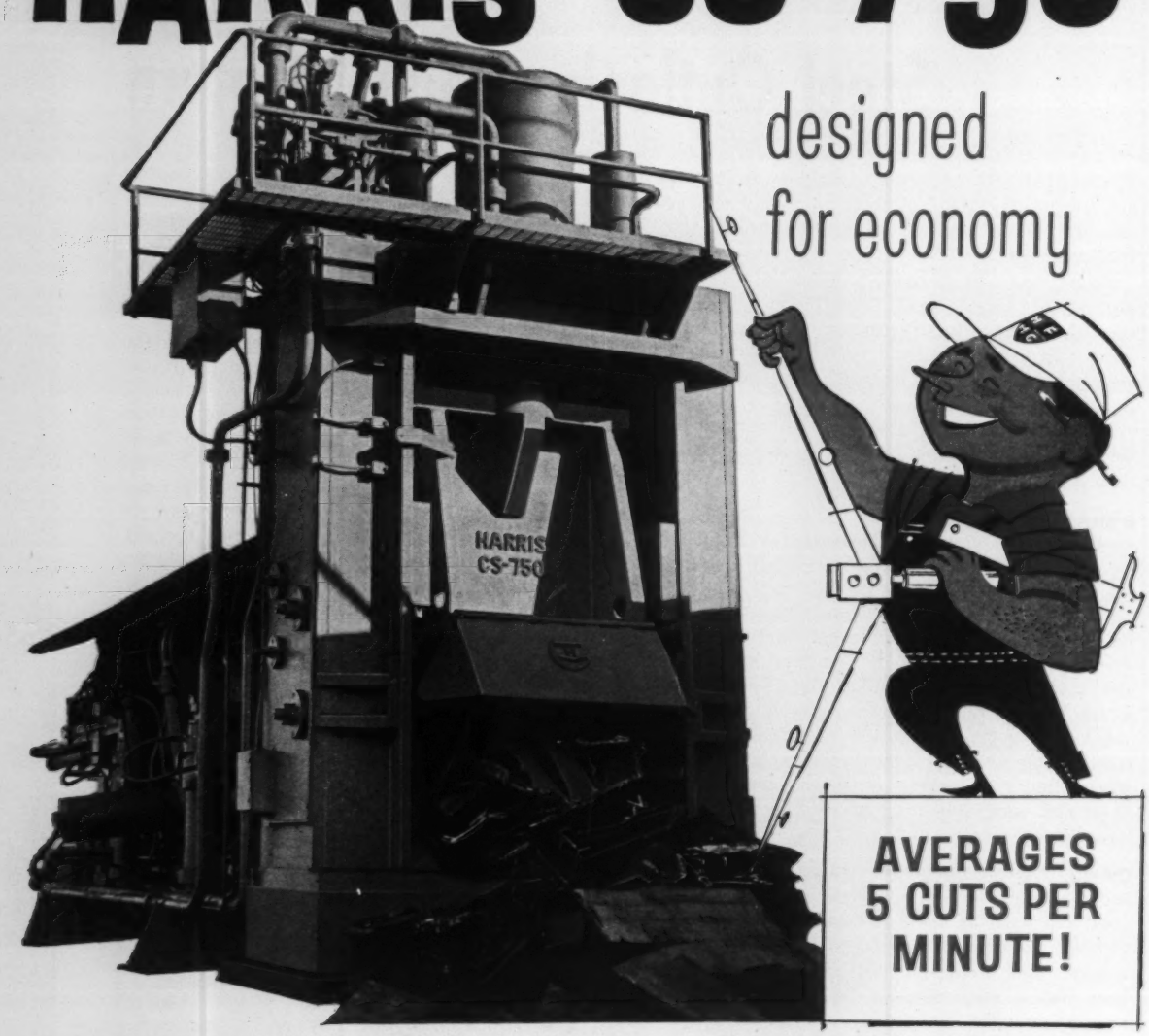

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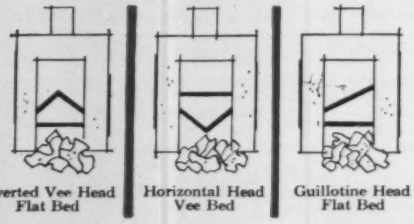

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STEEL
QUARTERLY SURVEY

COMPONENTS	CURRENT INVENTORIES					1st Quarter FORECAST		
	UNDER 10 DAYS	10-30 DAYS	30-60 DAYS	60-90 DAYS	3-6 MONTHS	LOWER	SAME	HIGHER
CASTINGS . . . . . Die, gray iron, malleable, nonferrous, steel.	2%	31%	49%	16%	2%	21%	61%	18%
OTHER FORMED COMPONENTS . . . . Forgings, stampings, springs, wire shapes.	1%	23%	48%	21%	7%	18%	63%	19%
MACHINED COMPONENTS . . . . . Bearings, couplings, cylinders, gears, screw machine products.	4%	32%	39%	21%	4%	18%	62%	20%
ELECTRICAL EQUIPMENT, MOTORS . .	14%	28%	38%	14%	6%	19%	63%	18%
FASTENERS	4%	32%	40%	15%	9%	22%	61%	17%
MECHANICAL RUBBER GOODS, BELTING	10%	46%	35%	7%	2%	20%	70%	10%

FIGURES are percentages of respondents to STEEL's quarterly survey. UNDERSCORED figures show how most respondents reported.

Part Buyers Say They Will Stand Pat

COMPONENT inventories appear to have reached the level desired by most buyers. The situation marks the end of a stockpile tailspin that lasted nearly a year. However, a buildup in the first quarter is not in sight.

Of the purchasing agents responding to STEEL's quarterly survey of components buyers, 30 per cent reveal reserves fell to lower levels than were reported in the last survey (see STEEL, Oct. 3, p. 98) and only 7 per cent had an upturn. However, respondents planning continued inventory reductions (19 per cent) and those planning increases (18 per cent) are the closest in several years, substantiating the belief that little change is expected in the first three months of this year. Buyers are continuing to hold commitments to the minimum to meet production schedules which are rarely hard pressed.

• **Comparison Shows**—The overall breakdown of present inventories vs. levels of three months ago comes out like this:

Under 10 days	5 vs. 6%
10 to 30 days	31 vs. 18%
30 to 60 days	43 vs. 50%
60 to 90 days	16 vs. 20%
Over 90 days	5 vs. 6%

• **General Decline**—The downturn in the fourth quarter, which exceeded expectations, was emphasized by a sharp shift of stocks into the 10 to 30 day category. In only four instances, did a product area fail to experience an across the board drop in categories over 30 days: Electrical equipment and motors, which had a 1 per cent rise in the 30 to 60 day group and a 2 percentage point increase in the over 90 day category; castings were up 4 percentage points in the 30 to 60 day period; other formed components registered no change in the 30 to 60 day column; rubber goods and belting failed to change in the three to six month group.

• **Little Change Seen** — Although little change in the total component inventory this quarter is indicated, buyers of goods in two product areas plan further cutbacks of significant proportions.

Purchasers of fasteners planning reductions outvoted those planning increases by 5 per cent. Twenty per cent of rubber goods and belting buyers, already with low inventories, anticipate further reductions, while only 10 per cent will add to stock levels.

Overstock mentions remained about the same as they were in October (20 per cent vs. 21 per cent). Numerous products were mentioned, with electrical goods leading the surplus parade. Delivery complaints ended a nine month slide, rising 7 percentage points over October gripes. Nevertheless, this is the second lowest level of such problems in more than two years, compared with 47 per cent last January and 30 per cent in January, 1959. Electrical equipment and bearings were noted most frequently. But here, again, a good number of items were listed. The diversity of products in both overstock and undersupply might indicate some inventory imbalances are present.

Sheets, Strip . . .

Sheet & Strip Prices, Pages 290 & 291

Inquiry for sheets is a little more buoyant, but buying is not sufficiently active to tighten deliveries. Hot rolled can still be had within two weeks, cold rolled in two to four weeks, and galvanized in two to three. In the case of galvanized, the delivery situation, if anything, is a little easier than it has been lately. Shipments on specialties, such as electrical sheets and enameling stock, average three weeks.

The current delivery situation is likely to remain for some time, even though more buying is done over coming weeks. Some mills have been reporting better January and first quarter bookings, and this is likely to result in a gradual stepup in production.

In general, no sharp upturn in ordering is anticipated. Appliance manufacturers' requirements are expected to lag over the next few weeks, and the same is true of such lines as door bucks, office furniture and shelving, and shipping containers.

What the auto industry will do in the way of buying is uncertain. However, reports of satisfactory auto sales at some points lend support to the view January automotive requirements will be fairly satisfactory, and may be even better in February. Nevertheless, some steelmen express concern over forecasts of reduced auto production for all of 1961.

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Whatever your needs in slitting, coiling and shearing equipment for mill, factory or warehouse, STAMCO has the answer. STAMCO has equipment available in a wide range of sizes and speeds for every coiling and sheeting operation.

- slitting and coiling lines
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- flying shear lines
- power squaring shears
- continuous processing lines
- mill equipment

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Carbon and Alloy Steel Output Gains Indicated

Carbon steel production in November totaled 5,639,213 net tons, reports the American Iron & Steel Institute. That compares with 6,298,683 tons in October and 6,556,824 in November, 1959. The total for the first 11 months this year was 85,562,780 tons vs. 73,775,134 in the same period of last year.

Production of alloy steel (other than stainless) in November amounted to 460,755 tons vs. 501,933 in October and 606,258 in November last year. The total for the first 11 months this year was 6,942,481 tons compared with 6,716,037 in the like period of 1959.

Output of stainless and heat resisting steels in November was 71,972 tons against 67,764 in October and 104,525 in November, 1959. During the first 11 months this year, the total was 936,499 net tons vs. 965,642 in the same period of 1959.

Steel Bars . . .

Bar Prices, Page 289

Hot carbon bar producers anticipate a little better business this month, both from the standpoint of orders and shipments. They look for no strong demand pressure, however, until the quarter is pretty well along.

Producers of cold finished bars are offering carbon steel for shipment within ten days to two weeks, where there's hot stock on hand. Most of the converters have substantial stocks of hot bars. Most also have some finished cold drawn bars on hand that are available for prompt shipment.

One feature of the cold drawn

(*Please turn to Page* 284)

A roll's life holds no secrets

Men like National's metallurgist Joe Marsalka see to that. Before your roll is born, National helps select the proper composition, grade and hardness. As it is being produced, our metallurgists carefully control chill locations, pouring procedures and heat treatment. When the roll is "full-grown" ultra-sonic testing equipment checks its internal soundness making sure your roll is ready for the tough life ahead. Even after your roll is shipped, National keeps in touch with its performance in your stand. This intimate knowledge of roll life is one reason we are able to consistently produce quality steel, iron and nodular iron rolls. It's a big reason why... NATIONAL'S THE GROWING NAME IN ROLLS.

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Subsidiary: St. Louis Car Company, St. Louis, Mo.

Kearney & Trecker machine tools

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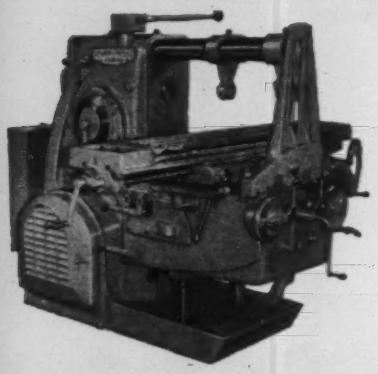
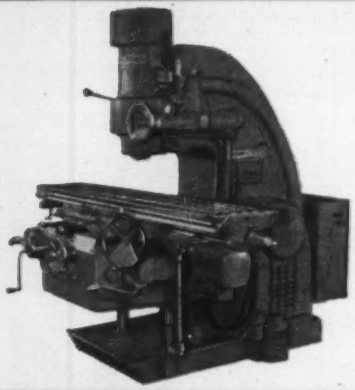
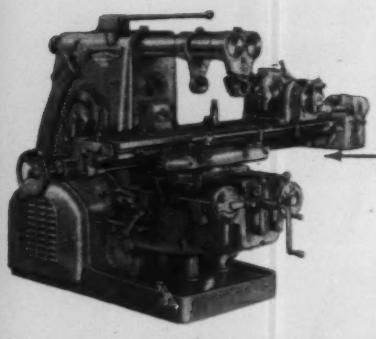


TF Series Knee Type Milling Machines

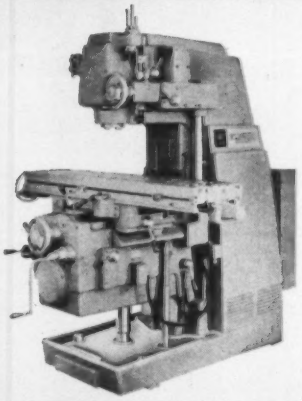
Strikingly new milling machines feature twin screw knee support for greater rigidity; new control center for ease of operation; improved Mono-Lever and Automatic Cycle Table Control; front-mounted backlash eliminator; adjustable saddle clamping gib; three bearing spindle that increases rigidity eight times over spindles without center bearing support, and many other features. TF's are available in five sizes Plain (left), Universal and Vertical (right) styles from 10hp to 50hp. (Catalog No. TF-58)

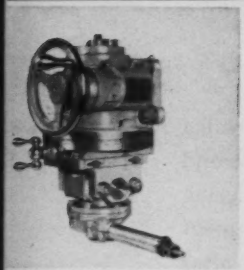




CH & S Series Knee Type Milling Machines

These modern knee type milling machines incorporate the latest design and operating features . . . greater capacity for power, speeds and feeds. Machines are available in Plain, Universal and Vertical styles . . . 5 to 15hp. (Catalog No. CH-59 and S-60)





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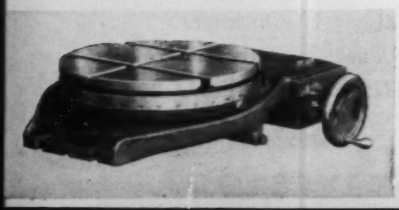
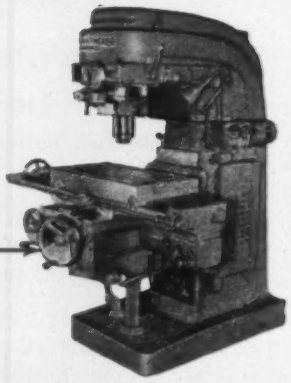
A complete selection for every milling requirement to convert standard machines into special purpose tools. Provide maximum productivity by supplementing with any of the various Kearney & Trecker standard attachments. Bulletins available on request.



Model 2D Rotary Head

Rotary head motion, combined with milling machine's ability to do boring, slotting, drilling, vertical milling, circular and angular milling, transmits complete blueprint into metal without changing setup. Speed range 250 to 4000 rpm; feed range .0002 to .008 ipr; rotary head feed range (16 changes) 2 to 3 rpm. (Catalog No. D-20)



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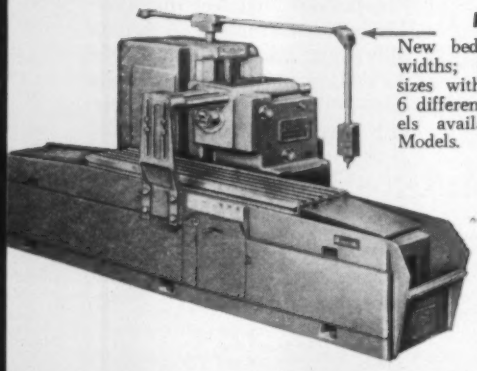
offer you more productivity and performance than ever before...

TODAY, Kearney & Trecker gives you several complete new lines of knee and bed type milling machines, precision boring machines and special production machines to meet growing metalworking needs.

Note the *exclusive* twin-screw support of the massive knee and saddle on the new TF Series milling machines... the compact, central control grouping... profit-making features typical of the advanced design you'll find on every machine shown.

For complete information on these new machines, see our nearest representative. Ask for catalogs listed here, or write Dept. ST58, Kearney & Trecker Corp., Milwaukee 14, Wis.

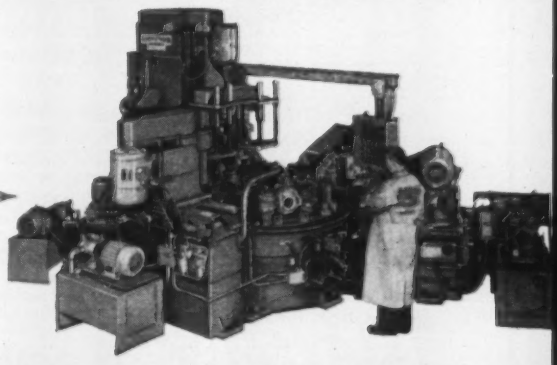


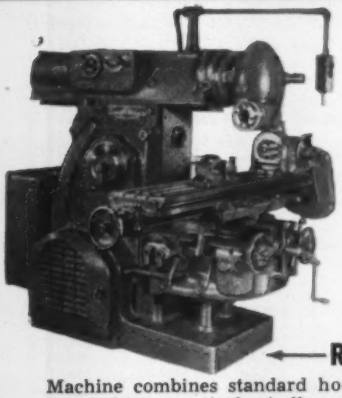
Mil-waukee-Mil Series

New bed-type design features: 2 table widths; 6 table sizes; 2 spindle head sizes with 3 speed ranges in each size; 6 different hp ratings; 72 standard models available in Simplex and Duplex Models. (Catalog No. MM-58)

Special Rotary Indexing and Transfer Machines

This 5-station rotary indexing machine features standard units: feed slides, quill feed, drill power units and rotary index table. Other special machines available. (Catalog No. SMD-10 and Data Sheet 1076)





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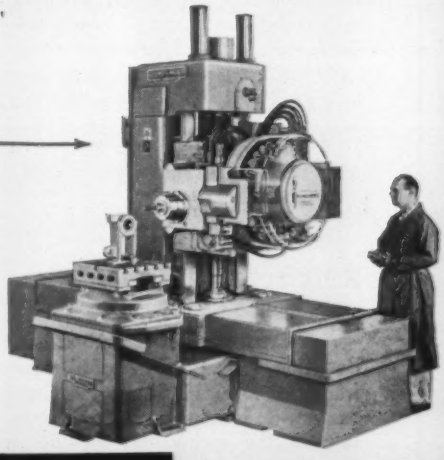
This single unit, tape-controlled machining center, unifies three basic processes — milling, drilling and boring. It is flexible automation of simple and complex machining operations on small- and medium-size lot production. Thirty-one tools are changed automatically on this new tape-controlled production machine. (Catalog No. TG-58)



Ram Head Milling Machines

Machine combines standard horizontal spindle with separate motor-driven vertical spindle mounted on sliding Ram. Ram may be equipped with either Universal, Vertical or Quill type head. Machines available in No. 2 to No. 4 sizes, Plain and Universal styles (Catalog No. RH-10)

Machine Tools Since 1898

KEARNEY & TRECKER MILWAUKEE

(*Concluded from Page 280*)
bar market is a recent spurt in government buying for arsenals and ammunition depots. However, some arms shops are delaying bar order placements pending installation of new machinery. Orders for cold drawn bars have been placed by the Raritan (N. J.) Arsenal, 135 tons going to the Superior Drawn Steel Co., Monaca, Pa., and 180 tons to the Hercules Drawn Steel Corp., Toledo, Ohio.

Tin Can Shipments Down In First Ten Months

Shipments of tin cans totaled 416,795 tons in October compared with 552,975 in September this year and 383,227 in October, 1959, reports the Census Bureau. The total for the first ten months was 4,137,831 tons, down from 4,334,353 in the like period last year.

The movement of aluminum cans was 1504 tons in October, 1534 in September this year, and 16,275 in the first ten months.

Tin cans for fruit and fruit juices amounted to 53,906 tons in October vs. 76,971 in September; for vegetable and vegetable juices, 94,899 in October vs. 185,530 in September. In October, 1959, 120,000 tons of tin cans in both categories were shipped.

In the first ten months, 640,341 tons of fruit and fruit juice cans and 736,456 tons of vegetable and vegetable juice cans were shipped. In the ten-month period of 1959, shipments in both categories amounted to 1,425,224 tons.

The movement of tin beer cans totaled 59,035 tons in October, 71,577 in September this year, and 56,508 in October a year ago. Shipments in the first ten months amounted to 736,372 tons vs. 791,656 in the same 1959 period.

Refractories . . .

Refractories Prices, Page 297

An expansion program at the Bessemer (Ala.) Works of the Refractories Div., H. K. Porter Company Inc., is scheduled for completion in the spring. It includes a manufacturing building, equipment, and an expanded product line. All structural steelwork has been completed, and 25 per cent of the new building is under roof.

The structure will house a tunnel kiln, eight bricks wide by 441 ft long, a 134 ft dryer, and a four car shuttle kiln for production of special shapes and short run items.

Wire . . .

Wire Prices, Pages 291 & 292

Production at the wire mills sagged sharply over the holidays. The recovery may not be as quick as some observers think because most industrial wire items have been moving slowly in recent weeks, and the outlook for the first quarter is not too clear.

A Connecticut highway closing Jan. 3 calls for heavier carbon grades, including 570 tons of mat reinforcement.

Tubular Goods . . .

Tubular Goods Prices, Page 295

Despite the yearend slump, the outlook appears to be a little better in the steel pipe and tubular goods market at the start of the first quarter. Demand for oil country goods is still improving. (December volume was the best for some producers since the first quarter last year.) At the same time, distributors of merchant pipe are entering slightly heavier orders for January-February shipment.

The pickup in ordering is limited, but it is expected to increase steadily, accelerating as construction is resumed on a broad scale this spring. Many pipe distributors are still holding back their orders, knowing they can get prompt shipments when needed.

Competition for merchant pipe tonnage among distributors is reported bringing out more liberal discounts on attractive tonnages.

Distributors . . .

Prices, Page 296

Bookings by steel service centers dropped 12 to 15 per cent last month from the November total, reflecting the usual seasonal factors. Distributors anticipate a slight gain in January, but feel that their market will remain sluggish as long as mills make prompt shipments of orders calling for tonnages usually channeled through service centers.

With demand light for practically

Steel Shipments by Markets—October, 1960

(Net tons; All grades)

	October, 1960		First Ten Months	
Markets:	**Tonnage**	**% of Total**	**Tonnage**	**% of Total**
Converting, processing	182,660	3.7	2,545,159	4.1
Forgings (except auto)	50,914	1.0	738,297	1.2
Fasteners	76,488	1.6	935,493	1.5
Warehouses:				
Oil & gas industry	74,240	1.5	962,390	1.5
All other	756,475	15.3	10,088,008	16.1
Total warehouse	830,715	16.8	11,050,398	17.6
Construction:				
Rail transportation	3,376	0.1	43,062	0.1
Oil & gas	114,525	2.3	1,939,792	3.1
All other	598,571	12.1	6,501,048	10.4
Total construction	716,472	14.5	8,483,902	13.6
Contractors' Products	242,613	4.9	3,178,673	5.1
Automotive:				
Cars, trucks, parts	1,131,771	22.9	12,349,929	19.7
Forgings	24,897	0.5	371,730	0.6
Total automotive	1,156,668	23.4	12,721,659	20.3
Rail transportation:				
Rails, track, equipment	17,675	0.3	678,236	1.1
Cars, locomotives	108,155	2.2	1,596,113	2.6
Transit systems	2,935	0.1	30,668	....
Total railroad	128,765	2.6	2,305,017	3.7
Shipbuilding	65,000	1.3	536,563	0.9
Aircraft	5,391	0.1	66,290	0.1
Oil & gas drilling	25,464	0.5	366,948	0.6
Mining, quarrying, etc.	23,336	0.5	245,635	0.4
Agricultural:				
Machinery	46,510	0.9	639,328	1.0
All other	16,919	0.4	208,803	0.3
Total agricultural	63,429	1.3	848,131	1.3
Machinery & tools	249,444	5.0	3,490,185	5.6
Elec. Machinery, etc.	134,115	2.7	1,762,449	2.8
Appliances, etc.	107,929	2.2	1,542,651	2.5
Other equipment	140,988	2.9	1,714,896	2.7
Containers:				
Cans & closures	280,809	5.7	4,517,097	7.2
Barrels, drums, etc.	54,467	1.1	731,462	1.2
All other	39,531	0.8	543,391	0.9
Total containers	374,807	7.6	5,791,950	9.3
Ordnance, other military	11,601	0.2	133,366	0.2
Nonclassified	173,621	3.5	1,813,171	2.9
Total domestic shipments	4,760,420	96.3	60,270,833	96.4
Exports	183,203	3.7	2,272,947	3.6
Total Shipments	4,943,623	100.0	62,543,780	100.0

Data from American Iron & Steel Institute.

all products, stocks are ample and well balanced. Secondary sheets are moving, but not at favorable price levels from the distributors' viewpoint. Bars, plates, and structurals also are selling in restricted volume.

The general price level at the yearend was somewhat lower than it was at the start of 1960.

Joseph T. Ryerson & Son Inc. has announced addition of Reynolds aluminum to its steel service center stocks at Cincinnati. The new stocks consist of plates, sheets, rods, bars, structurals, and pipe. Tooling plates, tread plates, and building sheets are also carried, while service is being given on aluminum building products, such as roofing, siding, roof deck, and wall panels.

November Blast Furnace Production Shows Decline

Blast furnace production (pig iron and ferroalloys) in November totaled 4,174,865 net tons (36,509 ferroalloys), reports the American Iron & Steel Institute. That compares with 4,510,819 tons (38,204 ferroalloys) in October and with 4,219,273 tons (20,172 ferroalloys) in November, 1959.

Output in the first 11 months this year was 63,412,225 tons (572,623 ferroalloys) with furnace operations averaging 71.6 per cent of capacity. That compares with 53,132,756 tons (383,477 ferroalloys) and operations averaging 61.4 per cent in the like period of 1959.

Production data by states for November and the first 11 months:

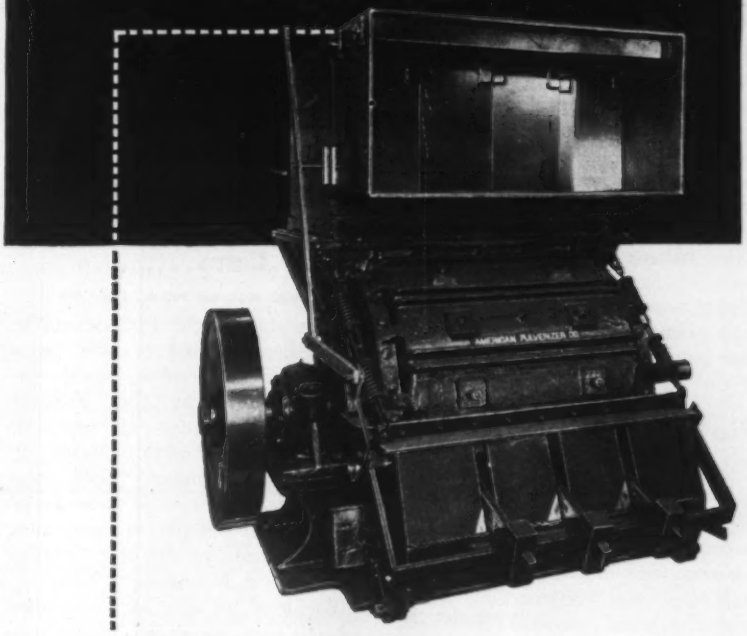
Blast Furnace Production—November, 1960
(Pig Iron, Ferromanganese, Spiegel)

(Net tons)

States	November, 1960	First 11 Months 1960	1959
Mass., New York	286,370	4,039,384	3,215,534
Pennsylvania	1,064,621	16,047,191	13,358,636
Md., Va., W. Va.	376,115	6,002,848	5,144,411
Ky., Tenn., Tex.	79,754	1,554,498	1,294,562
Alabama	243,664	3,323,915	3,268,047
Ohio	700,098	11,376,263	10,197,536
Indiana	506,507	7,906,813	5,785,620
Illinois	314,944	5,009,618	4,617,361
Michigan, Minnesota	346,990	4,699,031	3,577,723
Colo., Utah, Calif.	255,802	3,453,664	2,673,326
Totals	4,174,865*	63,412,225**	53,132,756†

*Includes 36,509 tons of ferromanganese and spiegeleisen.
**Includes 572,623 tons of ferromanganese and spiegeleisen.
†Includes 383,477 tons of ferromanganese and spiegeleisen.
Data from American Iron & Steel Institute.

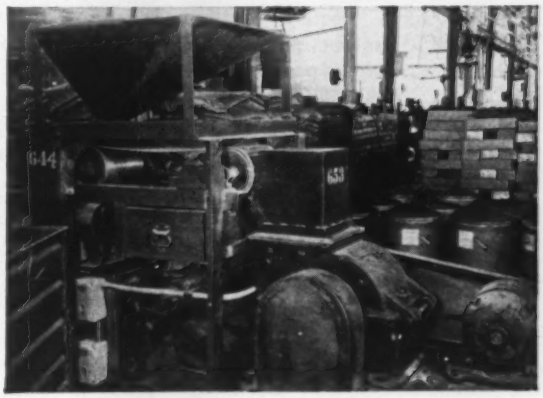
convert metal turnings into cash



Long, curly, troublesome metal turnings, reduced in an American Metal Turnings Crusher, can produce additional profits for your plant.

Reduced to chip form, metal turnings bring $2 to $5 more per ton. Handling metal chips by shovel or pneumatic systems is easier, too, and chips require 75% less storage space than bulky machine turnings. You'll recover more cutting oil from chips . . . up to 50 gallons per ton! More important, American Metal Turnings Crushers pay for themselves and produce substantial profits for years to come. Models available with capacities ranging from 1 to 50 tons per hour. To get all the details, write American today.

reclaim fused welding flux



One industrial plant saved more than $10,000 a year by using an American Welding Flux Crusher to regranulate fused welding flux. Write American for details.

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ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS
1539 MACKLIND SAINT LOUIS 10, MISSOURI

Pig Iron . . .

Pig Iron Prices, Page 296

Yearend dullness gripped the merchant iron market last week. Most consumers have refrained from making new purchases for several weeks in an effort to keep inventories at a minimum.

Actual consumption is slow. Foundries are feeling the effect of reduced orders for castings from automakers and other large users. Those supplying the railroad equipment industry are quiet. Lessened demand for cast iron pipe has brought on shorter workweeks in pipe plants and no improvement in this industry is expected to develop in the near future.

Plates . . .

Plate Prices, Page 289

Steel sales officials attribute current market softness in plates and structurals to seasonal factors. Cold weather and snow have forced a halt in some construction work, and the usual yearend efforts of consumers to keep inventories down have held mill shipments in check.

Plate orders for January shipment are picking up a little, and some producers think the month's shipments will run at least 5 per cent over those in December.

But even if January brings modest improvement in volume, the first quarter probably won't be much better than the fourth. Line pipe producers, currently needing business, won't require many plates until February or March.

Fabricating shops operating on small order backlogs have been buying cautiously, with sheared and universal plate shipments available from the mills in less than three weeks. Users are entering little first quarter tonnage, but Naval shipyards are reported beginning to take quotations on tonnage required during that period, including 1860 tons for delivery to the Brooklyn Navy Yard. The Portsmouth (N. H.) Navy Yard is placing orders for high tensile grades for shipment this quarter.

Rails, Cars . . .

Track Material Prices, Page 292

Domestic freight car awards in November declined to 3680 units from 5885 in October, reports the American Railway Car Institute and the Association of American Railroads. They were, however, up from the November, 1959, total 3424 cars.

November deliveries amounted to 3799 units vs. 4632 in October and 2218 in November, 1959.

Backlogs as of Dec. 1 totaled 14,603 cars on order in railroad shops and 8178 in commercial shops. Total: 22,781.

Canadian Steel Output Up In First 11 Months

While Canadian steel ingot production for the first 11 months of this year shows a slight gain over output in the like 1959 period, indications are the 1960 total will fall below the record set last year.

Ingot output in November amounted to 436,699 tons, 79 per cent of rated capacity. It compared with 479,069 tons (83.9 per cent) in October and 532,499 tons (96.4 per cent) in November, 1959.

In the 11 months, steel production totaled 5,339,002 tons vs. 5,276,264 in the same 1959 period.

Pig iron output in November was 334,105 tons vs, 368,043 in October, and 353,102 in November, 1959.

Production in the first 11 months totaled 3,984,479 tons vs. 3,810,741 in the same period last year. Prospects are a yearly record will be set.

Lake Shipments in 1960 Largest in Three Years

Combined shipments of iron ore, coal, and grain carried over the Great Lakes to Dec. 1, in the 1960 shipping season totaled 135,285,631 net tons, highest for the period in three years, reports the Lake Carriers' Association, Cleveland. Shipments in the same period the year before amounted to only 105,125,970 tons, but the movement was curtailed by the steel strike that year.

The November grain movement of 2,063,151 tons was the second highest since 1954. November was the first month since April in which U. S. lake vessels loaded more grain than overseas ships. They accounted for 58 cargoes vs. 42 for ships under foreign flags.

Iron ore cargoes moved in November totaled 1,942,980 gross tons, lowest for 11 years. Coal shipments of 3,613,805 tons fell to a seven year low.

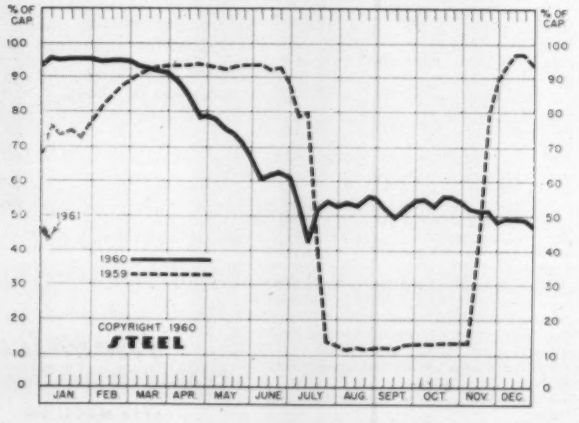
DISTRICT INGOT RATES

(Percentage of capacity utilized)

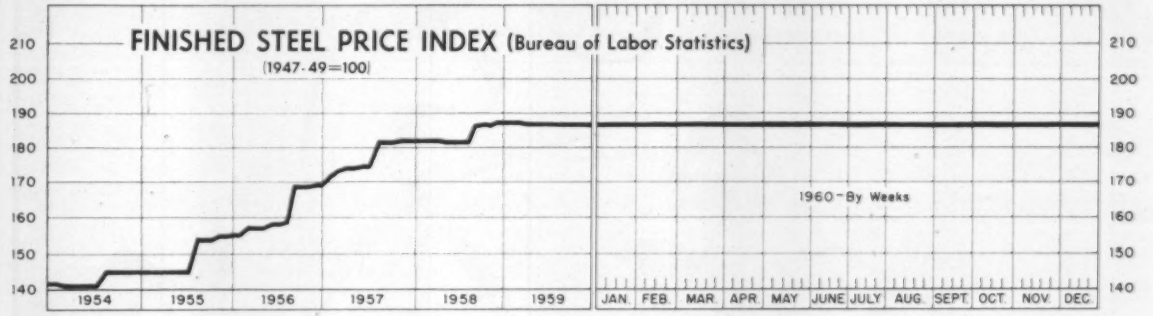
	Week Ended Jan. 1	Week Ago	Month Ago	Year Ago
Northeastern	36	48	51	102
Buffalo	36	40	45	100
Pittsburgh	32	42	46	98
Youngstown	22	34	37	94
Cleveland	33	41	50	98
Detroit	49	51	61	105
Chicago	50	52	52	94
Cincinnati	55	54	50	95
St. Louis	44	59	61	110
Southern	44	55	55	91
Western	51	53	48	93
Total Industry	39.4	46.5	48.9	96.3
Index (1947-49=100)	69.8	82.5	86.7	169.7
Net Tons (In thousands)	1,122	1,325	1,393	2,726

Current week's figures are preliminary. Weekly capacity (net tons): 2,849,306 in 1960 and 2,831,331 in 1959. Source: American Iron & Steel Institute.

NATIONAL STEELWORKS OPERATIONS



Price Indexes and Composites



Dec. 27, 1960	Week Ago	Month Ago	Dec. Index	Year Ago
186.2	186.2	186.2	186.2	186.8

AVERAGE PRICES OF STEEL (Bureau of Labor Statistics)

Week Ended Dec. 27

Prices include mill base prices and typical extras and deductions. Units are 100 lb except where otherwise noted in parentheses. For complete description of the following products and extras and deductions applicable to them, write to STEEL.

Rails, Standard No. 1	$5.825
Rails, Light, 40 lb	7.292
Tie Plates	6.875
Axles, Railway	10.175
Wheels, Freight Car, 33 in. (per wheel)	62.900
Plates, Carbon	6.350
Structural Shapes	6.167
Bars, Tool Steel, Carbon (lb)	0.560
Bars, Tool Steel, Alloy, Oil Hardening Die (lb)	0.680
Bars, Tool Steel, H.R. Alloy, High Speed, W 6.75, Cr 4.5, V 2.1, Mo 5.5, C 0.060 (lb)	1.400
Bars, Tool Steel, H.R. Alloy, High Speed, W18, Cr 4, V 1 (lb)	1.895
Bars, H.R., Alloy	10.775
Bars, H.R., Stainless, 303 (lb)	0.543
Bars, H.R., Carbon	6.675
Bars, Reinforcing	6.335
Bars, C.F., Carbon	10.710
Bars, C.F., Alloy	14.125
Bars, C.F., Stainless, 302 (lb)	0.570
Sheets, H.R., Carbon	6.350
Sheets, C.R., Carbon	7.300
Sheets, Galvanized	8.775
Sheets, C.R., Stainless, 302 (lb)	0.658
Sheets, Electrical	12.625
Strip, C.R., Carbon	9.489
Strip, C.R., Stainless, 430 (lb)	0.480
Strip, H.R., Carbon	6.250
Pipe, Black, Buttweld (100 ft)	19.495
Pipe, Galv., Buttweld (100 ft)	23.098
Pipe, Line (100 ft)	195.430
Casing, Oil Well, Carbon (100 ft)	201.080
Casing, Oil Well, Alloy (100 ft)	315.213
Tubes, Boiler (100 ft)	51.200
Tubing, Mechanical, Carbon (100 ft)	27.005
Tubing, Mechanical, Stainless, 304 (100 ft)	194.268
Tin plate, Hot-dipped, 1.25 lb (95 lb base box)	10.100
Tin Plate, Electrolytic, 0.25 lb (95 lb base box)	8.800
Black Plate, Canmaking Quality (95 lb base box)	7.900
Wire, Drawn, Carbon	10.575
Wire, Drawn, Stainless, 430 (lb)	0.665
Bale Ties (Bundles)	7.647
Nails, Wire, 8d Common	9.433
Wire, Barbed (80-rod spool)	8.414
Woven Wire Fence (20-rod roll)	21.063

STEEL's FINISHED STEEL PRICE INDEX

	Dec. 28 1960	Week Ago	Month Ago	Year Ago	5 Yr Ago
Index (1935-39 avg=100)	247.82	247.82	247.82	247.82	208.90
Index in cents per lb	6.713	6.713	6.713	6.713	5.659

STEEL's ARITHMETICAL PRICE COMPOSITES

Finished Steel, NT	$149.96	$149.96	$149.96	$149.96	$127.68
No. 2 Fdry, Pig Iron, GT	66.49	66.49	66.49	66.49	58.99
Basic Pig Iron, GT	65.99	65.99	65.99	65.99	58.49
Malleable Pig Iron, GT	67.27	67.27	67.27	67.27	59.77
Steelmaking Scrap, GT	29.33	29.00	28.83	41.33	51.83

Comparison of Prices

Comparative prices by districts in cents per pound except as otherwise noted. Delivered prices based on nearest production point.

FINISHED STEEL	Dec. 28 1960	Week Ago	Month Ago	Year Ago	5 Yr Ago
Bars, H.R., Pittsburgh	5.675	5.675	5.675	5.675	4.65
Bars, H.R., Chicago	5.675	5.675	5.675	5.675	4.65
Bars, H.R., deld., Philadelphia	5.97	5.97	5.97	5.975	4.90
Bars, C.R., Pittsburgh	7.65*	7.65*	7.65*	7.65*	5.90
Shapes, Std., Pittsburgh	5.50	5.50	5.50	5.50	4.60
Shapes, Std., Chicago	5.50	5.50	5.50	5.50	4.60
Shapes, deld., Philadelphia	5.745	5.745	5.745	5.77	4.88
Plates, Pittsburgh	5.30	5.30	5.30	5.30	4.50
Plates, Chicago	5.30	5.30	5.30	5.30	4.50
Plates, Coatesville, Pa.	5.30	5.30	5.30	5.30	4.80
Plates, Sparrows Point, Md.	5.30	5.30	5.30	5.30	4.50
Plates, Claymont, Del.	5.30	5.30	5.30	5.30	4.80
Sheets, H.R., Pittsburgh	5.10	5.10	5.10	5.10	4.325
Sheets, H.R., Chicago	5.10	5.10	5.10	5.10	4.325
Sheets, C.R., Pittsburgh	6.275	6.275	6.275	6.275	5.325
Sheets, C.R., Chicago	6.275	6.275	6.275	6.275	5.325
Sheets, C.R., Detroit	6.275	6.275	6.275	6.275	5.325-5.425
Sheets, Galv., Pittsburgh	6.875	6.875	6.875	6.875	5.85
Strip, H.R., Pittsburgh	5.10	5.10	5.10	5.10	4.325
Strip, H.R., Chicago	5.10	5.10	5.10	5.10	4.325
Strip, C.R., Pittsburgh	7.425	7.425	7.425	7.425	6.25
Strip, C.R., Chicago	7.425	7.425	7.425	7.425	6.25-6.35
Strip, C.R., Detroit	7.425	7.425	7.425	7.425	6.35
Wire, Basic, Pittsburgh	8.00	8.00	8.00	8.00	6.25
Nails, Wire, nonstock, Pitts.	8.95	8.95	8.95	8.95	7.60
Tin Plate (1.50 lb) box, Pitts.	$10.65	$10.65	$10.65	$10.65	$9.45

*Including 0.35c for special quality.

SEMIFINISHED STEEL					
Billets, forging, Pitts. (NT)	$99.50	$99.50	$99.50	$99.50	$84.50
Wire rods, ¼-⅜" Pitts.	6.40	6.40	6.40	6.40	5.025

PIG IRON, Gross Ton	Dec. 28 1960	Week Ago	Month Ago	Year Ago	5 Yr Ago
Bessemer, Pittsburgh	$67.00	$67.00	$67.00	$67.00	$59.50
Basic, Valley	66.00	66.00	66.00	66.00	58.50
Basic, deld., Philadelphia	70.18	70.18	70.18	70.41	62.16
No. 2 Fdry, NevilleIsland, Pa.	66.50	66.50	66.50	66.50	59.00
No. 2 Fdry, Chicago	66.50	66.50	66.50	66.50	59.00
No. 2 Fdry, deld., Phila.	70.68	70.68	70.68	70.91	62.66
No. 2 Fdry, Birmingham	62.50	62.50	62.50	62.50	55.00
No. 2 Fdry (Birm.), deld., Cin.	70.20	70.20	70.20	70.20	62.70
Malleable, Valley	66.50	66.50	66.50	66.50	59.00
Malleable, Chicago	66.50	66.50	66.50	66.50	59.00
Ferromanganese, net tons†	245.00	245.00	245.00	245.00	190.00

SCRAP, Gross Ton (Including broker's commission)					
No. 1 Heavy Melt, Pittsburgh	$26.50	$26.50	$26.50	$41.50	$51.00
No. 1 Heavy Melt, E. Pa.	35.00	34.00	34.00	42.00	55.00
No. 1 Heavy Melt, Chicago	26.50	26.50	26.00	40.50	49.50
No. 1 Heavy Melt, Valley	26.50	26.50	26.50	43.50	52.50
No. 1 Heavy Melt, Cleve.	23.50	23.50	23.50	40.50	51.50
No. 1 Heavy Melt, Buffalo	23.50	23.50	23.50	37.50	45.50
Rails, Rerolling, Chicago	48.50	48.50	46.50	61.50	71.00
No. 1 Cast, Chicago	37.50	37.50	36.50	54.50	50.50

COKE, Net Ton					
Beehive, Furn., Connlsvl.	$15.00	$15.00	$15.00	$15.00	$14.125
Beehive, Fdry., Connlsvl.	18.25	18.25	18.25	18.25	16.50
Oven, Fdry., Milwaukee	32.00	32.00	32.00	32.00	27.50

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Producers of alloys, metals and chemicals

VANCORAM

Steel Prices

Mill prices as reported to STEEL, Dec. 28, cents per pound except as otherwise noted. *Changes shown in italics.* Code number following mill point indicates producing company. Key to producers, page 290; footnotes, page 292.

SEMIFINISHED

INGOTS, Carbon, Forging (NT)
Munhall,Pa. U5 ....$76.00

INGOTS, Alloy (NT)
Detroit S41 ....$82.00
Economy,Pa. B14 ....82.00
Farrell,Pa. S3 ....82.00
Lowellville,O. S3 ....82.00
Midland,Pa. C18 ....82.00
Munhall,Pa. U5 ....82.00
Sharon,Pa. S3 ....82.00

BILLETS, BLOOMS & SLABS
Carbon Rerolling (NT)
Bartonville,Ill. K4 ...$82.00
Bessemer,Pa. U5 ....80.00
Buffalo R2 ....80.00
Clairton,Pa. U5 ....80.00
Ensley,Ala. T2 ....80.00
Fairfield,Ala. T2 ....80.00
Fontana,Calif. K1 ....90.50
Gary,Ind. U5 ....80.00
Johnstown,Pa. B2 ....80.00
Lackawanna,N.Y. B2 ..80.00
Munhall,Pa. U5 ....80.00
Owensboro,Ky. G8 ....80.00
S.Chicago,Ill. R2, U5 ..80.00
S.Duquesne,Pa. U5 ....80.00
Sterling,Ill. N15 ....80.00
Youngstown R2 ....80.00

Carbon, Forging (NT)
Bessemer,Pa. U5 ....$99.50
Buffalo R2 ....99.50
Canton,O. R2 ....102.00
Clairton,Pa. U5 ....99.50
Conshohocken,Pa. A3 .104.50
Ensley,Ala. T2 ....99.50
Fairfield,Ala. T2 ....99.50
Farrell,Pa. S3 ....99.50
Fontana,Calif. K1 ....109.00
Gary,Ind. U5 ....99.50
Geneva,Utah C11 ....99.50
Houston S5 ....104.50
Johnstown,Pa. B2 ....99.50
Lackawanna,N.Y. B2 ..99.50
LosAngeles B3 ....109.00
Midland,Pa. C18 ....99.50
Munhall,Pa. U5 ....99.50
Owensboro,Ky. G8 ....99.50
Seattle B3 ....109.00
Sharon,Pa. S3 ....99.50
S.Chicago R2, U5, W14..99.50
S.Duquesne,Pa. U5 ...99.50
S.SanFrancisco B3 ...109.00
Warren,O. C17 ....99.50

Alloy, Forging (NT)
Bethlehem,Pa. B2 ...$119.00
Bridgeport,Conn. C32..119.00
Buffalo R2 ....119.00
Canton,O. R2, T7 ....119.00
Conshohocken,Pa. A3 .126.00
Detroit S41 ....119.00
Economy,Pa. B14 ....119.00
Farrell,Pa. S3 ....119.00
Fontana,Calif. K1 ....140.00
Gary,Ind. U5 ....119.00
Houston S5 ....124.00
Ind.Harbor,Ind. Y1 ...119.00
Johnstown,Pa. B2 ....119.00
Lackawanna,N.Y. B2..119.00
LosAngeles B3 ....139.00
Lowellville,O. S3 ....119.00
Massillon,O. R2 ....119.00
Midland,Pa. C18 ....119.00
Munhall,Pa. U5 ....119.00
Owensboro,Ky. G8 ....119.00
Seattle(6) B3 ....140.00
Sharon,Pa. S3 ....119.00
S.Chicago R2,U5,W14 .119.00
S.Duquesne,Pa. U5 ...119.00
Struthers,O. Y1 ....119.00
Warren,O. C17 ....119.00

ROUNDS, SEAMLESS TUBE (NT)
Buffalo R2 ....$122.50
Canton,O. R2 ....125.00
Cleveland R2 ....122.50
Gary,Ind. U5 ....122.50
S.Chicago,Ill. R2,W14.122.50
S.Duquesne,Pa. U5 ...122.50
Warren,O. C17 ....122.50

SKELP
Aliquippa,Pa. J5 ....5.05
Benwood,W.Va. W10 ...5.05
Ind.Harbor,Ind. Y1 ....5.05
Munhall,Pa. U5 ....5.05
Pittsburgh J5 ....5.05
Warren,O. R2 ....5.05
Youngstown R2, U5 ....5.05

WIRE RODS
AlabamaCity,Ala. R2 ..6.40
Aliquippa,Pa. J5 ....6.40
Alton,Ill. L1 ....6.60
Bartonville,Ill. K4 ....6.50
Buffalo W12 ....6.40
Cleveland A7 ....6.40
Donora,Pa. A7 ....6.40
Fairfield,Ala. T2 ....6.40
Houston S5 ....6.65
IndianaHarbor,Ind. Y1..6.40
Johnstown,Pa. B2 ....6.40
Joliet,Ill. A7 ....6.40
KansasCity,Mo. S5 ....6.65
Kokomo,Ind. C16 ....6.50
LosAngeles B3 ....7.20
Minnequa,Colo. C10 ....6.65
Monessen,Pa. P7 ....6.40
Pittsburg,Calif. C11 ....7.20
Portsmouth,O. P12 ....6.40
Roebling,N.J. R5 ....6.50
S.Chicago,Ill. R2, W14..6.40
SparrowsPoint,Md. B2 ..6.50
Sterling,Ill.(1) N15 ....6.40
Sterling,Ill. N15 ....6.50
Struthers,O. Y1 ....6.40
Worcester,Mass. A7 ....6.70

STRUCTURALS

Carbon Steel Std. Shapes
AlabamaCity,Ala. R2 ...5.50
Aliquippa,Pa. J5 ....5.50
Atlanta A11 ....5.70
Bessemer,Ala. T2 ....5.50
Bethlehem,Pa. B2 ....5.55
Birmingham C15 ....5.50
Clairton,Pa. U5 ....5.50
Fairfield,Ala. T2 ....5.50
Fontana,Calif. K1 ....6.30
Gary,Ind. U5 ....5.50
Geneva,Utah C11 ....5.50
Houston S5 ....5.60
Ind.Harbor,Ind. I-2, Y1..5.50
Johnstown,Pa. B2 ....5.55
Joliet,Ill. P22 ....5.50
KansasCity,Mo. S5 ....5.60
Lackawanna,N.Y. B2 ..5.55
LosAngeles B3 ....6.20
Minnequa,Colo. C10 ....5.80
Munhall,Pa. U5 ....5.50
Niles,Calif. P1 ....6.25
Phoenixville,Pa. P4 ....5.55
Portland,Oreg. O4 ....6.25
Seattle B3 ....6.25
S.Chicago,Ill. U5, W14 .5.50
S.SanFrancisco B3 ....6.15
Sterling,Ill. N15 ....5.50
Torrance,Calif. C11 ....6.20
Weirton,W.Va. W6 ....5.50

Wide Flange
Bethlehem,Pa. B2 ....5.55
Clairton,Pa. U5 ....5.50
Fontana,Calif. K1 ....6.45
IndianaHarbor,Ind. I-2..5.50
Lackawanna,N.Y. B2 ..5.55
Munhall,Pa. U5 ....5.50
Phoenixville,Pa. P4 ....5.55
S.Chicago,Ill. U5 ....5.50
Sterling,Ill. N15 ....5.50
Weirton,W.Va. W6 ....5.50

Alloy Std. Shapes
Aliquippa,Pa. J5 ....6.80
Clairton,Pa. U5 ....6.80
Gary,Ind. U5 ....6.80
Houston S5 ....6.90
Munhall,Pa. U5 ....6.80
S.Chicago,Ill. U5, W14..6.80

H.S., L.A., Std. Shapes
Aliquippa,Pa. J5 ....8.05
Bessemer,Ala. T2 ....8.05
Bethlehem,Pa. B2 ....8.10
Clairton,Pa. U5 ....8.05
Fairfield,Ala. T2 ....8.05
Fontana,Calif. K1 ....8.85
Gary,Ind. U5 ....8.05
Geneva,Utah C11 ....8.05
Houston S5 ....8.15
Ind.Harbor,Ind. I-2, Y1..8.05
Johnstown,Pa. B2 ....8.10
KansasCity,Mo. S5 ....8.15
Lackawanna,N.Y. B2 ..8.10
LosAngeles B3 ....8.75
Munhall,Pa. U5 ....8.05
Seattle B3 ....8.80
S.Chicago,Ill. U5, W14..8.05
S.SanFrancisco B3 ....8.70
Sterling,Ill. N15 ....7.75
Struthers,O. Y1 ....8.05

H.S., L.A., Wide Flange
Bethlehem,Pa. B2 ....8.10
Ind.Harbor,Ind. I-2 ....8.05
Lackawanna,N.Y. B2 ..8.10
Munhall,Pa. U5 ....8.05
S.Chicago,Ill. U5 ....8.05
Sterling,Ill. N15 ....7.75

PILING

BEARING PILES
Bethlehem,Pa. B2 ....5.55
Ind.Harbor,Ind. I-2 ....5.50
Lackawanna,N.Y. B2 ..5.55
Munhall,Pa. U5 ....5.50
S.Chicago,Ill. I-2, U5 ..5.50

STEEL SHEET PILING
Ind.Harbor,Ind. I-2 ....6.50
Lackawanna,N.Y. B2 ..6.50
Munhall,Pa. U5 ....6.50
S.Chicago,Ill. I-2, U5 ..6.50
Weirton,W.Va. W6 ....6.50

PLATES

PLATES, Carbon Steel
AlabamaCity,Ala. R2 ..5.30
Aliquippa,Pa. J5 ....5.30
Ashland,Ky.(15) A10 ...5.30
Atlanta A11 ....5.50
Bessemer,Ala. T2 ....5.30
Clairton,Pa. U5 ....5.30
Claymont,Del. P4 ....5.30
Cleveland J5, R2 ....5.30
Coatesville,Pa. L7 ....5.30
Conshohocken,Pa. A3 ..5.30
Ecorse,Mich. G5 ....5.30
Fairfield,Ala. T2 ....5.30
Farrell,Pa. S3 ....5.30
Fontana,Calif.(30) K1 ..6.10
Gary,Ind. U5 ....5.30
Geneva,Utah C11 ....5.30
GraniteCity,Ill. G4 ....5.40
Harrisburg,Pa. P4 ....5.30
Houston S5 ....5.40
Ind.Harbor,Ind. I-2, Y1 .5.30
Johnstown,Pa. B2 ....5.30
Lackawanna,N.Y. B2 ..5.30
Mansfield,O. E6 ....5.30
Minnequa,Colo. C10 ....6.15
Munhall,Pa. U5 ....5.30
Newport,Ky. A2 ....5.30
Pittsburgh J5 ....5.30
Riverdale,Ill. A1 ....5.30
Seattle B3 ....6.20
Sharon,Pa. S3 ....5.30
S.Chicago,Ill. U5, W14 ..5.30
SparrowsPoint,Md. B2 ..5.30
Sterling,Ill. N15 ....5.30
Steubenville,O. W10 ....5.30
Warren,O. R2 ....5.30
Youngstown U5, Y1 ....5.30
Youngstown(27) R2 ....5.30

PLATES, Carbon Abras. Resist.
Claymont,Del. P4 ....7.05
Fontana,Calif. K1 ....7.85
Geneva,Utah C11 ....7.05
Houston S5 ....7.15
Johnstown,Pa. B2 ....7.05
SparrowsPoint,Md. B2 ..7.05

PLATES, Wrought Iron
Economy,Pa. B14 ....14.10

PLATES, H.S., L.A.
Aliquippa,Pa. J5 ....7.95
Ashland,Ky. A10 ....7.95
Bessemer,Ala. T2 ....7.95
Clairton,Pa. U5 ....7.95
Claymont,Del. P4 ....7.95
Cleveland J5, R2 ....7.95
Coatesville,Pa. L7 ....7.95
Conshohocken,Pa. A3 ..7.95
Economy,Pa. B14 ....7.95
Ecorse,Mich. G5 ....7.95
Fairfield,Ala. T2 ....7.95
Farrell,Pa. S3 ....7.95
Fontana,Calif.(30) K1 ..8.75
Gary,Ind. U5 ....7.95
Geneva,Utah C11 ....7.95
Houston S5 ....8.05
Ind.Harbor,Ind. I-2, Y1.7.95
Johnstown,Pa. B2 ....7.95
Munhall,Pa. U5 ....7.95
Pittsburgh J5 ....7.95
Seattle B3 ....8.85
Sharon,Pa. S3 ....7.95
S.Chicago,Ill. U5, W14..7.95
SparrowsPoint,Md. B2 ..7.95
Sterling,Ill. N15 ....7.625
Warren,O. R2 ....7.95
Youngstown U5, Y1 ....7.95

PLATES, Alloy
Aliquippa,Pa. J5 ....7.50
Claymont,Del. P4 ....7.50
Coatesville,Pa. L7 ....7.50
Economy,Pa. B14 ....7.50
Farrell,Pa. S3 ....7.50
Fontana,Calif. K1 ....8.30
Gary,Ind. U5 ....7.50
Houston S5 ....7.60
Ind.Harbor,Ind. Y1 ....7.50
Johnstown,Pa. B2 ....7.50
Lowellville,O. S3 ....7.50
Munhall,Pa. U5 ....7.50
Newport,Ky. A2 ....7.50
Pittsburgh J5 ....7.50
Seattle B3 ....8.40
Sharon,Pa. S3 ....7.50
S.Chicago,Ill. U5, W14..7.50
SparrowsPoint,Md. B2 ..7.50
Youngstown Y1 ....7.50

FLOOR PLATES
Cleveland J5 ....6.375
Conshohocken,Pa. A3 ..6.375
Harrisburg,Pa. P4 ....6.375
Ind.Harbor,Ind. I-2 ....6.375
Munhall,Pa. U5 ....6.375
Pittsburgh J5 ....6.375
S.Chicago,Ill. U5 ....6.375

PLATES, Ingot Iron
Ashland c.l.(15) A10 ...5.55
Ashland l.c.l.(15) A10 ..6.05
Cleveland c.l. R2 ....6.05
Warren,O. R2 ....6.05

BARS

BARS, Hot-Rolled Carbon (Merchant Quality)
Ala.City,Ala.(9) R2 ...5.675
Aliquippa,Pa.(9) J5 ...5.675
Alton,Ill. L1 ....5.875
Atlanta(9) A11 ....5.875
Bessemer,Ala.(9) T2 ...5.675
Birmingham(9) C15 ...5.675
Buffalo(9) R2 ....5.675
Canton,O.(23) R2 ....6.15
Clairton,Pa.(9) U5 ....5.675
Cleveland(9) R2 ....5.675
Ecorse,Mich.(9) G5 ....5.675
Emeryville,Calif. J7 ...6.425
Fairfield,Ala.(9) T2 ....5.675
Fairless,Pa.(9) U5 ....5.825
Fontana,Calif.(9) K1 ...6.3.5
Gary,Ind.(9) U5 ....5.675
Houston(9) S5 ....5.925
Ind.Harbor(9) I-2, Y1..5.675
Johnstown,Pa.(9) B2 ..5.675
Joliet,Ill. P2 ....5.675
KansasCity,Mo.(9) S5..5.925
Lackawanna(9) B2 ....5.675
LosAngeles(9) B3 ....6.375
Massillon,O.(23) R2 ....6.15
Midland,Pa.(23) C18 ..6.025
Milton,Pa. M18 ....5.825
Minnequa,Colo. C10 ....6.125
Niles,Calif. P1 ....6.375
Owensboro,Ky.(9) G8..6.025
Pittsburg,Calif.(9) C11..6.375
Pittsburgh(9) J5 ....5.675
Portland,Oreg. O4 ....6.425
Riverdale,Ill.(9) A1 ...5.675
Seattle(9) A24,B3,N15 .6.425
S.Ch'c'go(9)R2,U5,W14 5.675
S.Duquesne,Pa.(9) U5..5.675
S.SanFran.,Calif.(9)B3 6.425
Sterling,Ill.(1)(9) N15..5.675
Sterling,Ill.(9) N15 ....5.775
Struthers,O.(9) Y1 ....5.675
Tonawanda,N.Y. B12 ..5.675
Torrance,Calif.(9) C11 .6.375
Warren,O. C17 ....6.025
Youngstown(9) R2,U5..5.675

BARS, Hot-Rolled Alloy
Aliquippa,Pa. J5 ....6.725
Bethlehem,Pa. B2 ....6.725
Bridgeport,Conn. C32 ...6.80
Buffalo R2 ....6.725
Canton,O. R2 T7 ....6.725
Clairton,Pa. U5 ....6.725
Detroit S41 ....6.725
Economy,Pa. B14 ....6.725
Ecorse,Mich. G5 ....6.725
Farrell,Pa. S3 ....6.725
Fontana,Calif. K1 ....7.775
Gary,Ind. U5 ....6.725
Houston S5 ....6.975
Ind.Harbor,Ind. I-2, Y1 6.725
Johnstown,Pa. B2 ....6.725
KansasCity,Mo. S5 ....6.975
Lackawanna,N.Y. B2 ..6.725
LosAngeles B3 ....7.775
Lowellville,O. S3 ....6.725
Massillon,O. R2 ....6.725
Midland,Pa. C18 ....6.725
Owensboro,Ky. G8 ....6.725
Pittsburgh J5 ....6.725
Seattle(6) B3 ....7.825
Sharon,Pa. S3 ....6.725
S.Chicago R2, U5, W14..6.725
S.Duquesne,Pa. U5 ....6.725
Struthers,O. Y1 ....6.725
Warren,O. C17 ....6.725
Youngstown U5 ....6.725

BARS & SMALL SHAPES, H.R. High-Strength, Low-Alloy
Aliquippa,Pa. J5 ....8.30
Bessemer,Ala. T2 ....8.30
Bethlehem,Pa. B2 ....8.30
Clairton,Pa. U5 ....8.30
Cleveland R2 ....8.30
Ecorse,Mich. G5 ....8.30
Fairfield,Ala. T2 ....8.30
Fontana,Calif. K1 ....9.00
Gary,Ind. U5 ....8.30
Houston S5 ....8.55
Ind.Harbor,Ind. Y1 ....8.30
Johnstown,Pa. B2 ....8.30
KansasCity,Mo. S5 ....8.55
Lackawanna,N.Y. B2 ..8.30
LosAngeles B3 ....9.00
Pittsburgh J5 ....8.30
Seattle B3 ....9.05
S.Chicago,Ill. R2, W14..8.30
S.Duquesne,Pa. U5 ....8.30
S.SanFrancisco B3 ....9.05
Sterling,Ill. N15 ....7.925
Struthers,O. Y1 ....8.30
Youngstown U5 ....8.30

BAR SIZE ANGLES; H.R. Carbon
Bethlehem,Pa.(9) B2 ..5.825
Houston(9) S5 ....5.925
KansasCity,Mo.(9) S5..5.925
Lackawanna(9) B2 ....5.675
Sterling,Ill. N15 ....5.775
Sterling,Ill.(1) N15 ....5.675
Tonawanda,N.Y. B12 ..5.675

BAR SIZE ANGLES; S. SHAPES
Aliquippa,Pa. J5 ....5.675
Atlanta A11 ....5.875
Joliet,Ill. P22 ....5.675
Minnequa,Colo. C10 ....6.125
Niles,Calif. P1 ....6.375
Pittsburgh J5 ....5.675
Portland,Oreg. O4 ....6.425
Seattle B3 ....6.425

BAR SIZE ANGLES; S. SHAPES Wrought Iron
Economy,Pa. B14 ....16.45

BAR SHAPES, Hot-Rolled Alloy
Aliquippa,Pa. J5 ....6.80
Clairton,Pa. U5 ....6.80
Gary,Ind. U5 ....6.80
Houston S5 ....7.05
KansasCity,Mo. S5 ....7.05
Pittsburgh J5 ....6.80
Youngstown U5 ....6.80

BARS, C.F. Leaded (Including leaded extra) Carbon
LosAngeles P2, S30 ..11.75*

Alloy
Ambridge,Pa. W18 ...10.175
BeaverFalls,Pa. M12 ..10.175
Camden,N.J. P13 ....10.35
Chicago W18 ....10.175
Elyria,O. W8 ....10.175
Monaca,Pa. S17 ....10.175
Newark,N.J. W18 ....10.35
SpringCity,Pa. K3 ....10.35

*Grade A; add 0.5c for Grade B.

BARS, Cold-Finished Carbon
Ambridge,Pa. W18 ....7.65
BeaverFalls,Pa. M12,R2 .7.65
Birmingham C15 ....8.25
Buffalo B5 ....7.70
Camden,N.J. P13 ....8.10
Carnegie,Pa. C12 ....7.65
Chicago W18 ....7.65
Cleveland A7, C20 ....7.65
Detroit B5, P17 ....7.85
Detroit S41 ....7.65
Donora,Pa. A7 ....7.65
Elyria,O. W8 ....7.65
FranklinPark,Ill. N5 ...7.65
Gary,Ind. R2 ....7.65
GreenBay,Wis. F7 ....7.65
Hammond,Ind. J5, L2 ...7.65
Hartford,Conn. R2 ....8.15
Harvey,Ill. B5 ....7.65
LosAngeles(49) S30 ....9.10
LosAngeles(49) P2, R2..9.10
Mansfield,Mass. B5 ....8.20
Massillon,O. R2, R8 ....7.65
Midland,Pa. C18 ....7.65
Monaca,Pa. S17 ....7.65
Newark,N.J. W18 ....8.10
NewCastle,Pa.(17) B4 ..7.65
Pittsburgh J5 ....7.65
Plymouth,Mich. P5 ....7.90
Putnam,Conn. W18 ....8.20
Readville,Mass. C14 ....8.20
Seattle(49) S30 ....9.10
S.Chicago,Ill. W14 ....7.65
SpringCity,Pa. K3 ....8.10
Struthers,O. Y1 ....7.65
Warren,O. C17 ....7.65
Waukegan,Ill. A7 ....7.65
Willimantic,Conn. J5 ...8.15
Youngstown F3, Y1 ....7.65

BARS, Cold-Finished Carbon (Turned and Ground)
Cumberland,Md.(5) C19..6.55

BARS, Cold-Finished Alloy
Ambridge,Pa. W18 ....9.025
BeaverFalls,Pa. M12,R2 9.025
Bethlehem,Pa. B2 ....9.025
Bridgeport,Conn. C32 ..9.175
Buffalo B5 ....9.025
Camden,N.J. P13 ....9.20
Canton,O. T7 ....9.025
Carnegie,Pa. C12 ....9.025
Chicago W18 ....9.025
Cleveland A7, C20 ....9.025
Detroit B5, P17 ....9.225
Detroit S41 ....9.025
Donora,Pa. A7 ....9.025
Elyria,O. W8 ....9.025
FranklinPark,Ill. N5 ...9.025
Gary,Ind. R2 ....9.025
GreenBay,Wis. F7 ....9.025
Hammond,Ind. J5, L2 ...9.025
Hartford,Conn. R2 ....9.325
Harvey,Ill. R5 ....9.025
Lackawanna,N.Y. B3 ...9.025
LosAngeles P2, S30 ...11.00
Mansfield,Mass. B5 ....9.325
Massillon,O. R2, R8 ....9.025
Midland,Pa. C18 ....9.025
Monaca,Pa. S17 ....9.025
Newark,N.J. W18 ....9.20
Plymouth,Mich. P5 ....9.225
S.Chicago,Ill. W14 ....9.025
SpringCity,Pa. K3 ....9.20

Struthers,O. Y1 .....9.025
Warren,O. C17 .....9.025
Waukegan,Ill. A7 .....9.025
Willimantic,Conn. J5 ..9.325
Worcester,Mass. A7 ...9.325
Youngstown F3, Y1 ...9.025

BARS, Reinforcing, Billet (To Fabricators)

AlabamaCity,Ala. R2 ..5.675
Atlanta A11 .....5.25
Birmingham C15 .....5.25
Buffalo R2 .....5.675
Cleveland R2 .....5.675
Ecorse,Mich. G5 .....5.675
Emeryville,Calif. J7 ...6.425
Fairfield,Ala. T2 .....5.675
Fairless,Pa. U5 .....5.825
Fontana,Calif. K1 .....6.375
Ft.Worth,Tex.(26) T4 ..5.50
Gary,Ind. U5 .....5.675
Houston S5 .....5.675
Ind.Harbor,Ind. I-2,Y1.5.675
Johnstown,Pa. B2 .....5.675
Joliet,Ill. P22 .....5.675
KansasCity,Mo. S5 .....5.675
Kokomo,Ind. C16 .....5.775
Lackawanna,N.Y. B2..5.675
LosAngeles B3 .....6.375
Madison,Ill. L1 .....5.875
Milton,Pa. M18 .....5.825
Minnequa,Colo. C10 ...6.125
Niles,Calif. P1 .....6.375
Pittsburg,Calif. C11 ...6.375
Pittsburgh J5 .....5.675
Portland,Oreg. O4 .....6.425
SandSprings,Okla. S5 ..5.675
Seattle A24, B3, N14 ..6.425
S.Chicago,Ill. R2, W14.5.675
S.Duquesne,Pa. U5 .....5.675
S.SanFrancisco B3 ...6.425
SparrowsPoint,Md. B2..5.675
Steelton,Pa. B2 .....5.675
Sterling,Ill.(1) N15 ...5.675
Sterling,Ill. N15 .....5.775
Struthers,O. Y1 .....5.675
Tonawanda,N.Y. B12 ...6.10
Torrance,Calif. C11 ...6.375
Youngstown R2, U5 ..5.675

BARS, Reinforcing, Billet (Fabricated: to Consumers)

Baltimore B2 .....7.42
Boston B2, U8 .....8.15
Chicago U8 .....7.41
Cleveland U8 .....7.39
Houston S5 .....7.35
Johnstown,Pa. B2 .....7.33
KansasCity,Mo. S5 .....7.35
Lackawanna,N.Y. B2 ..7.35
Marion,O. P11 .....6.70
Newark,N.J. U8 .....7.80
Philadelphia U8 .....7.63
Pittsburgh J5, U8 .....7.35
SandSprings,Okla. S5 ...7.35
Seattle A24, B3, N14 ..7.95
SparrowsPoint,Md. B2 ..7.33
St.Paul U8 .....8.17
Williamsport,Pa. S19 ...7.25

BARS, Wrought Iron

Economy,Pa.(S.R.)B14 15.10
Economy,Pa.(D.R.)B14 19.30
Econ.(DirectRolled)B14 13.55
Economy(Staybolt)B14 19.80
McK.Rks.(S.R.) L5 ...14.50
McK.Rks.(D.R.)L5 ...19.80
McK.Rks.(Staybolt)L5. 20.95

BARS, Rail Steel

ChicagoHts.(3) C2, I-2.5.575
ChicagoHts.(4)(44) I-2.5.675
ChicagoHts.(4) C2 ....5.675
Franklin,Pa.(3) F5 ....5.575
Franklin,Pa.(4) F5 ....5.675
JerseyShore,Pa.(3) J8 .5.55
Marion,O.(3) P11 ....5.575
Tonawanda(3) B12 ....5.575
Tonawanda(4) B12 ....6.10

SHEETS

SHEETS, Hot-Rolled Steel (18 Gage and Heavier)

AlabamaCity,Ala. R2 ...5.10
Allenport,Pa. P7 .....5.10
Aliquippa,Pa. J5 .....5.10
Ashland,Ky.(8) A10 ....5.10
Cleveland J5, R2 .....5.10
Conshohocken,Pa. A3 ...5.15
Detroit(8) M1 .....5.10
Ecorse,Mich. G5 .....5.10
Fairfield,Ala. T2 .....5.10
Fairless,Pa. U5 .....5.15
Farrell,Pa. S3 .....5.10
Fontana,Calif. K1 ....5.825
Gary,Ind. U5 .....5.10
Geneva,Utah C11 .....5.20
GraniteCity,Ill.(8) G4 ..5.20
Ind.Harbor,Ind. I-2, Y1.5.10
Irvin,Pa. U5 .....5.10
Lackawanna,N.Y. B2 ..5.10
Munhall,Pa. U5 .....5.10
Mansfield,O. E6 .....5.10
Munhall,Pa. U5 .....5.10
Newport,Ky. A2 .....5.10
Niles,O. M21, S3 .....5.10
Pittsburg,Calif. C11 ....5.80
Pittsburgh J5 .....5.10
Portsmouth,O. P12 ....5.10
Riverdale,Ill. A1 .....5.10
Sharon,Pa. S3 .....5.10
S.Chicago,Ill. U5, W14..5.10
SparrowsPoint,Md. B2 ..5.10
Steubenville,O. W10 ....5.10
Warren,O. R2 .....5.10
Weirton,W.Va. W6 ....5.10
Youngstown U5, Y1 ....5.10

SHEETS, H.R. (19 Ga. & Lighter)

Niles,O. M21, S3 .....6.275

SHEETS, H.R. Alloy

Gary,Ind. U5 .....8.40
Ind.Harbor,Ind. Y1 ....8.40
Irvin,Pa. U5 .....8.40
Munhall,Pa. U5 .....8.40
Newport,Ky. A2 .....8.40
Youngstown U5, Y1 ....8.40

SHEETS, H.R. (14 Ga. & Heavier) High-Strength, Low-Alloy

Aliquippa,Pa. J5 .....7.525
Ashland,Ky. A10 .....7.525
Cleveland J5, R2 .....7.525
Conshohocken,Pa. A3 ..7.575
Ecorse,Mich. G5 .....7.525
Fairfield,Ala. T2 .....7.525
Fairless,Pa. U5 .....7.575
Farrell,Pa. S3 .....7.525
Fontana,Calif. K1 .....8.25
Gary,Ind. U5 .....7.525
Ind.Harbor,Ind. I-2, Y1 7.525
Irvin,Pa. U5 .....7.525
Lackawanna(35) B2 ...7.525
Munhall,Pa. U5 .....7.525
Niles,O. S3 .....7.525
Pittsburgh J5 .....7.525
S.Chicago,Ill. U5, W14.7.525
Sharon,Pa. S3 .....7.525
SparrowsPoint(36) B2..7.525
Warren,O. R2 .....7.525
Weirton,W.Va. W6 ....7.525
Youngstown U5, Y1 ...7.525

SHEETS, Hot-Rolled Ingot Iron (18 Gage and Heavier)

Ashland,Ky.(8) A10 ...5.35
Cleveland R2 .....5.875
Warren,O. R2 .....5.875

SHEETS, Cold-Rolled Ingot Iron

Cleveland R2 .....7.05
Middletown,O. A10 ....6.775
Warren,O. R2 .....7.05

SHEETS, Cold-Rolled Steel (Commercial Quality)

AlabamaCity,Ala. R2 ..6.275
Aliquippa,Pa. J5 .....6.275
Allenport,Pa. P7 .....6.275
Cleveland J5, R2 .....6.275
Conshohocken,Pa. A3 ..6.325
Detroit M1 .....6.275
Ecorse,Mich. G5 .....6.275
Fairfield,Ala. T2 .....6.275
Fairless,Pa. U5 .....6.325
Follansbee,W.Va. F4 ..6.275
Fontana,Calif. K1 .....7.40
Gary,Ind. U5 .....6.275
GraniteCity,Ill. G4 ....6.375
Ind.Harbor,Ind. I-2, Y1 6.275
Irvin,Pa. U5 .....6.275
Lackawanna,N.Y. B2 ..6.275
Mansfield,O. E6 .....6.275
Middletown,O. A10 ....6.275
Newport,Ky. A2 .....6.275
Pittsburg,Calif. C11 ..7.225
Pittsburgh J5 .....6.275
Portsmouth,O. P12 ....6.275
SparrowsPoint,Md. B2..6.275
Steubenville,O. W10 ...6.275
Warren,O. R2 .....6.275
Weirton,W.Va. W6 ....6.275
Yorkville,O. W10 ....6.275
Youngstown Y1 .....6.275

SHEETS, Cold-Rolled, High-Strength, Low-Alloy

Aliquippa,Pa. J5 .....9.275
Cleveland J5, R2 .....9.275
Ecorse,Mich. G5 .....9.275
Fairless,Pa. U5 .....9.325
Fontana,Calif. K1 ....10.40
Gary,Ind. U5 .....9.275
Ind.Harbor,Ind. I-2, Y1 9.275
Lackawanna(38) B2 ..9.275
Pittsburgh J5 .....9.275
SparrowsPoint(33) B2..9.275
Warren,O. R2 .....9.275
Weirton,W.Va. W6 ....9.275
Youngstown Y1 .....9.275

SHEETS, Culvert

	Cu Steel	Cu Fe
Ala.City,Ala. R2	7.225	....
Ashland,Ky. A10	7.225	7.475
Canton,O. R2	7.225	....
Fairfield,Ala. T2	7.225	7.475
Gary,Ind. U5	7.225	7.475
GraniteCity,Ill. G4	7.325	....
Ind.Harbor I-2	7.225	7.475
Irvin,Pa. U5	7.225	7.475
Kokomo,Ind. C16	7.325	....
MartinsFry. W10	7.225	7.475
Pitts.,Calif. C11	7.975	....
Pittsburgh J5	7.225	....
SparrowsPt. B2	7.225	....

SHEETS, Culvert—Pure Iron

Ind.Harbor,Ind. I-2 ...7.475

SHEETS, Enameling

Ashland,Ky. A10 .....6.775
Cleveland R2 .....6.775
Fairfield,Ala. T2 .....6.775
Gary,Ind. U5 .....6.775
Ind.Harbor,Ind. I-2, Y1 6.775
Irvin,Pa. U5 .....6.775
Middletown,O. A10 ....6.775
Niles,O. M21, S3 .....6.775
SparrowsPoint,Md. B2..6.775
Youngstown Y1 .....6.775

BLUED STOCK, 29 Gage

Dover,O. E6 .....8.70
Ind.Harbor,Ind. I-2 ....8.70
Mansfield,O. E6 .....8.70
Warren,O. R2 .....8.70
Yorkville,O. W10 .....8.70

SHEETS, Long Terne, Steel

Follansbee,W.Va. W10 .7.225
Gary,Ind. U5 .....7.225
Mansfield,O. E6 .....7.225
Middletown,O. A10 ....7.225
Niles,O. M21, S3 ....7.225
Warren,O. R2 .....7.225

SHEETS, Long Terne, Ingot Iron

Middletown,O. A10 ....7.625

SHEETS, Aluminum Coated

Butler,Pa. A10 (type 1) 9.525
Butler,Pa. A10 (type 2) 9.625
Irvin,Pa. U5 (type 1) ..9.525

SHEETS, Wall Casing

Fontana,Calif. K1 ....7.325

SHEETS, Galvanized High-Strength, Low-Alloy

Irvin,Pa. U5 .....10.125
Pittsburgh J5 .....10.125
SparrowsPt.(39) B2 ..10.025

SHEETS, Galvannealed Steel

Canton,O. R2 .....7.275
Irvin,Pa. U5 .....7.275

SHEETS, Galvanized Ingot Iron (Hot-Dipped Continuous)

Ashland,Ky. A10 .....7.125
Middletown,O. A10 ....7.125

SHEETS, Electrogalvanized

Cleveland(28) R2 .....7.65
Niles,O.(28) R2 .....7.65
Weirton,W.Va. W6 ....7.50

SHEETS, Galvanized Steel Hot-Dipped

AlabamaCity,Ala. R2..6.875‡
Ashland,Ky. A10 ....6.875‡
Canton,O. R2 .....6.875‡
Dover,O. E6 .....6.875†
Fairfield,Ala. T2 ....6.875†
Gary,Ind. U5 .....6.875†
GraniteCity,Ill. G4 ...6.975*
Ind.Harbor,Ind. I-2 ..6.875†
Irvin,Pa. U5 .....6.875†
Kokomo,Ind. C16 ....6.975‡
MartinsFerry,O. W10..6.875*
Middletown,O. A10 ..6.875†
Pittsburg,Calif. C11 ..7.625*
Pittsburgh J5 .....6.875†
SparrowsPt.,Md. B2 ..6.875†
Warren,O. R2 .....6.875†
Weirton,W.Va. W6 ...6.875*

*Continuous and noncontinuous. †Continuous. ‡Noncontinuous.

Key to Producers

A1 Acme Steel Co.
A2 Acme-Newport Steel Co.
A3 Alan Wood Steel Co.
A4 Allegheny Ludlum Steel
A5 Alloy Metal Wire Div., H. K. Porter Co. Inc.
A6 American Shim Steel Co.
A7 American Steel & Wire Div., U. S. Steel Corp.
A8 Anchor Drawn Steel Co.
A9 Angell Nail & Chaplet
A10 Armco Steel Corp.
A11 Atlantic Steel Co.
A24 Alaska Steel Mills Inc.
A25 Algoma Steel Corp. Ltd.

B1 Babcock & Wilcox
B2 Bethlehem Steel Co.
B3 Bethlehem Steel Co., Pacific Coast Div.
B4 Blair Strip Steel Co.
B5 Bliss & Laughlin Inc.
B8 Braeburn Alloy Steel
B9 Brainard Steel Div., Sharon Steel Corp.
B10 E. & G. Brooke, Wickwire Spencer Steel Div., Colo. Fuel & Iron
B12 Buffalo Steel Corp.
B14 A. M. Byers Co.
B15 J. Bishop & Co.

C1 Calstrip Steel Corp.
C2 Calumet Steel Div., Borg-Warner Corp.
C4 Carpenter Steel Co.
C9 Colonial Steel Co.
C10 Colorado Fuel & Iron
C11 Columbia-Geneva Steel
C12 Columbia Steel & Shaft.
C13 Columbia Tool Steel Co.
C14 Compressed Steel Shaft.
C15 Connors Steel Div., H. K. Porter Co., Inc.
C16 Continental Steel Corp.
C17 Copperweld Steel Co.
C18 Crucible Steel Co.
C19 Cumberland Steel Co.
C20 Cuyahoga Steel & Wire
C23 Charter Wire Inc.
C24 G. O. Carlson Inc.
C32 Carpenter Steel of N.Eng.
D2 Detroit Steel Corp.
D4 Disston Div., H. K. Porter Co. Inc.
D6 Driver-Harris Co.
D7 Dickson Weatherproof Nail Co.
D8 Damascus Tube Co.
D9 Wilbur B. Driver Co.

E1 Eastern Gas&Fuel Assoc.
E2 Eastern Stainless Steel
E6 Empire-Reeves Steel
E10 Enamel Prod. & Plating

F2 Firth Sterling Inc.
F3 Fitzsimmons Steel Co.
F4 Follansbee Steel Corp.
F5 Franklin Steel Div., Borg-Warner Corp.
F6 Fretz-Moon Tube Co.
F7 Ft. Howard Steel & Wire
F8 Ft. Wayne Metals Inc.

G4 Granite City Steel Co.
G5 Great Lakes Steel Corp.
G6 Greer Steel Co.
G8 Green River Steel Corp.

H1 Hanna Furnace Corp.
H7 Helical Tube Co.

I-1 Igoe Bros. Inc.
I-2 Inland Steel Co.
I-3 Interlake Iron Corp.
I-4 Ingersoll Steel Div., Borg-Warner Corp.
I-6 Ivins Steel Tube Works
I-7 Indiana Steel & Wire Co.

J1 Jackson Iron & Steel Co.
J3 Jessop Steel Co.
J4 Johnson Steel & Wire Co.
J5 Jones & Laughlin Steel
J6 Joslyn Mfg. & Supply
J7 Judson Steel Corp.
J8 Jersey Shore Steel Co.

K1 Kaiser Steel Corp.
K2 Keokuk Electro-Metals
K3 Keystone Drawn Steel
K4 Keystone Steel & Wire
K7 Kenmore Metals Corp.

L1 Laclede Steel Co.
L2 LaSalle Steel Co.
L3 Latrobe Steel Co.
L6 Lone Star Steel Co.
L7 Lukens Steel Co.
L8 Leschen Wire Rope Div., H. K. Porter Co. Inc.

M1 McLouth Steel Corp.
M4 Mahoning Valley Steel
M6 Mercer Pipe Div., Sawhill Tubular Products
M8 Mid-States Steel & Wire
M12 Moltrup Steel Products
M14 McInnes Steel Co.
M16 Md. Fine & Specialty Wire Co. Inc.
M17 Metal Forming Corp.
M18 Milton Steel Div., Merritt-Chapman&Scott
M21 Mallory-Sharon Metals Corp.
M22 Mill Strip Products Co.
M23 Mill Strip Products Co. of Pennsylvania

N1 National-Standard Co.
N2 National Supply Co.
N3 National Tube Div., U. S. Steel Corp.
N5 Nelsen Steel & Wire Co.
N6 New England High Carbon Wire Co.
N8 Newman-Crosby Steel
N14 Northwest. Steel Rolling Mills Inc.
N15 Northwestern S.&W. Co.
N20 Neville Ferro Alloy Co.

O4 Oregon Steel Mills

P1 Pacific States Steel Corp.
P2 Pacific Tube Co.
P4 Phoenix Steel Corp.
P5 Pilgrim Drawn Steel
P6 Pittsburgh Coke&Chem.
P7 Pittsburgh Steel Co.
P11 Pollak Steel Co.
P12 Portsmouth Div., Detroit Steel Corp.
P13 Precision Drawn Steel
P15 Pittsburgh Metallurgical
P16 Page Steel & Wire Div., American Chain & Cable
P17 Plymouth Steel Corp.
P19 Pitts. Rolling Mills
P20 Prod. Steel Strip Corp.
P22 Phoenix Mfg. Co.
P24 Phil. Steel & Wire Corp.

R2 Republic Steel Corp.
R3 Rhode Island Steel Corp.
R5 Roebling's Sons, John A.
R6 Rome Strip Steel Co.
R8 Reliance Div.,EatonMfg.
R9 Rome Mfg. Co.
R10 Rodney Metals Inc.

S1 Seneca Wire & Mfg. Co.
S3 Sharon Steel Corp.
S4 Sharon Tube Co.
S5 Sheffield Div., Armco Steel Corp.
S6 Shenango Furnace Co.
S7 Simmons Co.
S8 Simonds Saw & Steel Co.
S12 Spencer Wire Corp.
S13 Standard Forgings Corp.
S14 Standard Tube Co.
S15 Stanley Works
S17 Superior Drawn Steel Co.
S18 Superior Steel Div., Copperweld Steel Co.
S19 Sweet's Steel Co.
S20 Southern States Steel
S23 Superior Tube Co.
S25 Stainless Welded Prod.
S26 Specialty Wire Co. Inc.
S30 Sierra Drawn Steel Div., Bliss & Laughlin Inc.
S40 Seneca Steel Service
S41 Stainless & Strip Div., J & L Steel Corp.
S42 Southern Elec. Steel Co.
S43 Seymour Mfg. Co.
S44 Screw & Bolt Corp. of America
S45 Somers Brass Co.
S46 Steel Co. of Canada

T2 Tenn. Coal & Iron Div., U. S. Steel Corp.
T3 Tenn. Products & Chemical Corp.
T4 Texas Steel Co.
T5 Thomas Strip Div., Pittsburgh Steel Co.
T6 Thompson Wire Co.
T7 Timken Roller Bearing
T9 Tonawanda Iron Div., Am. Rad. & Stan. San.
T13 Tube Methods Inc.
T19 Techalloy Co. Inc.

U3 Union Wire Rope Corp.
U4 Universal-Cyclops Steel
U5 U. S. Steel Corp.
U6 U. S. Pipe & Foundry
U7 Ulbrich Stainless Steels
U8 U. S. Steel Supply Div., U. S. Steel Corp.
U11 Union Carbide Metals Co.
U13 Union Steel Corp.

V2 Vanadium-Alloy Steel
V3 Vulcan-Kidd Steel Div., H. K. Porter Co.

W1 Wallace Barnes Steel Div., Associated Spring
W2 Wallingford Steel Co.
W3 Washburn Wire Co.
W4 Washington Steel Corp.
W6 Weirton Steel Co.
W8 Western Automatic Machine Screw Co.
W9 Wheatland Tube Co.
W10 Wheeling Steel Corp.
W12 Wickwire Spencer Steel Div., Colo. Fuel & Iron
W13 Wilson Steel & Wire Co.
W14 Wisconsin Steel Div., International Harvester
W15 Woodward Iron Co.
W18 Wyckoff Steel Co.
Y1 Youngstown Sheet & Tube

STRIP

STRIP, Hot-Rolled Carbon

Ala. City, Ala. (27) R2 ...5.10
Allenport, Pa. P7 ...5.10
Alton, Ill. L1 ...5.30
Ashland, Ky. (8) A10 ...5.10
Atlanta A11 ...5.10
Bessemer, Ala. T2 ...5.10
Birmingham C15 ...5.10
Conshohocken, Pa. A3 ...5.15
Detroit M1 ...5.10
Ecorse, Mich. G5 ...5.10
Fairfield, Ala. T2 ...5.10
Farrell, Pa. S3 ...5.10
Fontana, Calif. K1 ...5.825
Gary, Ind. U5 ...5.10
Ind. Harbor, Ind. I-2, Y1 ..5.10
Johnstown, Pa. (25) B2 ...5.10
Lackaw'na, N.Y. (25) B2 .5.10
LosAngeles (25) B3 ...5.85
LosAngeles C1 ...8.60
Minnequa, Colo. C10 ...6.20
Riverdale, Ill. A1 ...5.10
SanFrancisco S7 ...6.60
Seattle (25) B3 ...6.10
Seattle N14 ...6.60
Sharon, Pa. S3 ...5.10
S. Chicago, Ill. W14 ...5.10
S. SanFrancisco (25) B3 ..5.85
SparrowsPoint, Md. B2 ..5.10
Torrance, Calif. C11 ...5.85
Warren, O. R2 ...5.10
Weirton, W.Va. W6 ...5.10
Youngstown U5 ...5.10

STRIP, Hot-Rolled Alloy

Carnegie, Pa. S18 ...8.40
Farrell, Pa. S3 ...8.40
Gary, Ind. U5 ...8.40
Houston S5 ...8.65
Ind. Harbor, Ind. Y1 ...8.40
KansasCity, Mo. S5 ...8.65
LosAngeles B3 ...9.60
Lowellville, O. S3 ...8.40
Newport, Ky. A2 ...8.40
Sharon, Pa. A2, S3 ...8.40
S. Chicago, Ill. W14 ...8.40
Youngstown U5, Y1 ...8.40

STRIP, Hot-Rolled High-Strength, Low-Alloy

Ashland, Ky. A10 ...7.575
Bessemer, Ala. T2 ...7.575
Conshohocken, Pa. A3 ..7.575
Ecorse, Mich. G5 ...7.575
Fairfield, Ala. T2 ...7.575
Farrell, Pa. S3 ...7.575
Gary, Ind. U5 ...7.575
Ind. Harbor, Ind. I-2, Y1 7.575
Lackawanna, N.Y. B2 ..7.575
LosAngeles (25) B3 ...8.325
Seattle (25) B3 ...8.575
Sharon, Pa. S3 ...7.575
S. Chicago, Ill. W14 ...7.575
S. SanFrancisco (25) B3 .8.325
SparrowsPoint, Md. B2 .7.575
Warren, O. R2 ...7.575
Weirton, W.Va. W6 ...7.575
Youngstown U5, Y1 ...7.575

STRIP, Hot-Rolled Ingot Iron

Ashland, Ky. (8) A10 ...5.35
Warren, O. R2 ...5.875

STRIP, Cold-Rolled Carbon

Anderson, Ind. G6 ...7.425
Baltimore T6 ...7.425
Boston T6 ...7.975
Buffalo S40 ...7.425
Cleveland A7, J5 ...7.425
Dearborn, Mich. S3 ...7.425
Detroit D2, M1, P20 ..7.425
Dover, O. G6 ...7.425
Evanston, Ill. M22 ...7.525
Farrell, Pa. S3 ...7.425
Follansbee, W.Va. W10 .7.425
Fontana, Calif. K1 ...9.20
FranklinPark, Ill. T6 ..7.525
Ind. Harbor, Ind. Y1 ...7.425
Indianapolis S41 ...7.575
LosAngeles C1, S41 ...9.30
McKeesport, Pa. E10 ..7.525
NewBedford, Mass. R10 .7.875
NewBritain, Conn. S15 .7.875
NewCastle, Pa. B4, M23 7.425
NewHaven, Conn. D2 ..7.875
NewKensington, Pa. A6 .7.425
Pawtucket, R.I. R3, N8 .7.975
Philadelphia P24 ...7.875
Pittsburgh J5 ...7.425
Riverdale, Ill. A1 ...7.525
Rome, N.Y. (32) R6 ...7.425
Sharon, Pa. S3 ...7.425
Trenton, N.J. (31) R5 ..8.875
Warren, O. R2, T5 ...7.425
Worcester, Mass. A7 ...7.975

STRIP, Cold-Rolled Alloy

Boston T6 ...15.90
Cleveland A7 ...15.55
Carnegie, Pa. S18 ...15.55
Dover, O. G6 ...15.55
Farrell, Pa. S3 ...15.55
FranklinPark, Ill. T6 ..15.55
Harrison, N.J. S18 ...15.55
Indianapolis S41 ...15.70
LosAngeles S41 ...17.75
Lowellville, O. S3 ...15.55
Pawtucket, R.I. N8 ...15.90
Riverdale, Ill. A1 ...15.55
Sharon, Pa. S3 ...15.55
Worcester, Mass. A7 ...15.85
Youngstown S41 ...15.55

STRIP, Cold-Rolled High-Strength, Low-Alloy

Cleveland A7 ...10.80
Dearborn, Mich. S3 ...10.80
Dover, O. G6 ...10.80
Farrell, Pa. S3 ...10.80
Ind. Harbor, Ind. Y1 ...10.80
Sharon, Pa. S3 ...10.80
Warren, O. R2 ...10.80
Weirton, W. Va. W6 ...10.80
Youngstown Y1 ...10.80

STRIP, Galvanized (Continuous)

Farrell, Pa. S3 ...7.50
Sharon, Pa. S3 ...7.50

STRIP, Cold-Finished Spring Steel (Annealed)

	0.26-0.40C	0.41-0.60C	0.61-0.80C	0.81-1.05C	1.06-1.35C
Anderson, Ind. G6	9.10	....	....	....	....
Baltimore T6	9.50	10.70	12.90	15.90	18.85
Boston T6	9.50	10.70	12.90	15.90	18.85
Bristol, Conn. W1	....	10.70	12.90	16.10	19.30
Carnegie, Pa. S18	8.95	10.40	12.60	15.60	....
Cleveland A7	8.95	10.40	12.60	15.60	18.55
Dearborn, Mich. S3	9.05	10.50	12.70	....	....
Detroit D2	9.05	10.50	12.70	15.70	....
Dover, O. G6	8.95	10.40	12.60	15.60	18.55
Evanston, Ill. M22	9.05	10.40	12.60	15.60	....
Farrell, Pa. S3	8.95	10.40	12.60	15.60	18.55
Fostoria, O. S1	10.05	10.40	12.60	15.60	....
FranklinPark, Ill. T6	9.05	10.40	12.60	15.60	18.55
Harrison, N.J. C18	....	....	12.90	16.10	19.30
Indianapolis S41	9.10	10.55	12.60	15.60	18.55
LosAngeles C1	11.15	12.60	14.80	17.80	....
LosAngeles S41	11.15	12.60	14.80	....	....
NewBritain, Conn. S15	9.40	10.70	12.90	15.90	18.85
NewCastle, Pa. B4, M23	8.95	10.40	12.60	15.60	....
NewHaven, Conn. D2	9.40	10.70	12.90	15.90	....
NewKensington, Pa. A6	8.95	10.40	12.60	15.60	....
NewYork W3	....	10.70	12.90	16.10	19.30
Pawtucket, R.I. N8	9.50	10.70	12.90	15.90	18.85
Riverdale, Ill. A1	9.05	10.40	12.60	15.60	18.55
Rome, N.Y. R6	8.95	10.40	12.60	15.60	18.55
Sharon, Pa. S3	8.95	10.40	12.60	15.60	18.55
Trenton, N.J. R5	....	10.70	12.90	15.90	18.85
Warren, O. T5	8.95	10.40	12.60	15.60	18.55
Worcester, Mass. A7, T6	9.50	10.70	12.90	15.90	18.85
Youngstown S41	8.95	10.40	12.60	15.60	18.55

Spring Steel (Tempered)			Up to 0.80C	0.81-1.05C	1.06-1.35C
Bristol, Conn. W1	....	....	18.85	22.95	27.80
Buffalo W12	....	....	18.85	....	....
Fostoria, O. S1	....	....	19.05	22.15	....
FranklinPark, Ill. T6	....	....	19.20	23.30	28.15
Harrison, N.J. C18	....	....	18.85	22.95	27.80
NewYork W3	....	....	18.85	22.95	27.80
Palmer, Mass. W12	....	....	18.85	....	....
Trenton, N.J. R5	....	....	18.85	22.95	27.80
Worcester, Mass. A7, T6	....	....	18.85	22.95	27.80
Youngstown S41	....	....	19.20	23.30	28.15

STRIP, C.R., Electrogalvanized

Cleveland A7 ...7.425*
Dover, O. G6 ...7.425*
Evanston, Ill. M22 ...7.525*
McKeesport, Pa. E10 ...7.50*
NewCastle, Pa. M23 ..7.425*
Riverdale, Ill. A1 ...7.525*
Warren, O. B9, S3, T5 .7.425*
Worcester, Mass. A7 ...7.975
Youngstown S41, Y1 .7.425*

*Plus galvanizing extras.

STRIP, Cold-Rolled Ingot Iron

Warren, O. R2 ...8.175

TIGHT COOPERAGE HOOP

Atlanta A11 ...5.825
Farrell, Pa. S3 ...5.525
Riverdale, Ill. A1 ...5.675
Sharon, Pa. S3 ...5.525
Youngstown U5 ...5.525

TIN MILL PRODUCTS

TIN PLATE, Electrolytic (Base Box)

	0.25 lb	0.50 lb	0.75 lb
Aliquippa, Pa. J5	$9.10	$9.35	$9.75
Fairfield, Ala. T2	9.20	9.45	9.85
Fairless, Pa. U5	9.20	9.45	9.85
Fontana, Calif. K1	9.75	10.00	10.40
Gary, Ind. U5	9.10	9.35	9.75
GraniteCity, Ill. G4	9.20	9.45	9.85
IndianaHarbor, Ind. I-2, Y1	9.10	9.35	9.75
Irvin, Pa. U5	9.10	9.35	9.75
Niles, O. R2	9.10	9.35	9.75
Pittsburg, Calif. C11	9.75	10.00	10.40
SparrowsPoint, Md. B2	9.10	9.35	9.75
Weirton, W.Va. W6	9.10	9.35	9.75
Yorkville, O. W10	9.10	9.35	9.75

ELECTROLYTIC TIN-COATED SHEET (Dollars per 100 lb)

Aliquippa, Pa. J5 (21-27 Ga.)	7.90	8.10	....
IndianaHarbor, Ind. Y1 (20-27 Ga.)	7.90	....	....
Niles, O. R2 (20-27 Ga.)	7.90	8.10	8.30

ELECTROLYTIC THIN TIN PLATE (¼ lb coating in coils)

	Base Box			
	45 lb	50 lb	55 lb	60 lb
Fairfield, Ala. T2	$6.20	$6.35	$6.50	$6.65
Fairless, Pa. U5	6.20	6.35	6.50	6.65
Gary, Ind. U5	6.10	6.25	6.40	6.55
Irvin, Pa. U5	6.10	6.25	6.40	6.55
SparrowsPoint, Md. B2	6.10	6.25	6.40	6.55

TIN PLATE, Hot Dipped 1.25 1.50

Common Coke	lb	lb
Aliquippa, Pa. J5	$10.40	$10.65
Fairfield, Ala. T2	10.50	10.75
Fontana, Calif. K1	11.05	11.30
Gary, Ind. U5	10.40	10.65
Irvin, Pa. U5	10.40	10.65
Pitts., Calif. C11	11.05	11.30
Sp. Pt., Md. B2	10.40	10.65
Weirton, W.Va. W6	10.40	10.65
Yorkville, O. W10	10.40	10.65

BLACK PLATE (Base Box)

Aliquippa, Pa. J5 ...$8.20
Fairfield, Ala. T2 ...8.30
Fairless, Pa. U5 ...8.30
Fontana, Calif. K1 ...8.85
Gary, Ind. U5 ...8.20
GraniteCity, Ill. G4 ...8.30
Ind. Harbor, Ind. I-2, Y1 .8.20
Irvin, Pa. U5 ...8.20
Niles, O. R2 ...8.20
Pittsburg, Calif. C11 ...8.85
SparrowsPoint, Md. B2 ..8.20
Weirton, W.Va. W6 ...8.20
Yorkville, O. W10 ...8.20

HOLLOWARE ENAMELING (Black Plate) (29 Gage)

Aliquippa, Pa. J5 ...7.85
Gary, Ind. U5 ...7.85
GraniteCity, Ill. G4 ...7.95
Ind. Harbor, Ind. Y1 ...7.85
Irvin, Pa. U5 ...7.85
Yorkville, O. W10 ...7.85

SILICON STEEL

C.R. COILS & CUT LENGTHS (22 Ga.)

Fully Processed (Semiprocessed ½c lower)	Field	Armature	Electric	Motor	Dynamo
BeechBottom, W.Va. W10	....	11.70	12.40	13.35	14.65
Brackenridge, Pa. A4	....	....	12.40	13.35	14.65
GraniteCity, Ill. G4	9.975*	11.30*	12.00*	13.15*	....
IndianaHarbor, Ind. I-2	9.875*	11.20*	11.90*	13.05*	....
Mansfield, O. E6	9.875*	11.70	12.40	13.55	14.65
Newport, Ky. A2	9.875	11.70*	12.40*	13.55*	14.65*
Niles, O. M21	9.875*	11.70	12.40	13.55	....
Vandergrift, Pa. U5	9.875*	11.70	12.40	13.55	14.65
Warren, O. R2	9.875*	11.70	12.40	13.55	14.65
Zanesville, O. A10	....	11.70†	12.40	13.55	14.65

	Stator
Mansfield, O. E6	8.10
Vandergrift, Pa. U5	8.10
Warren, O. R2 (Locore)	8.10

SHEETS (22 Ga., coils & cut lengths)

Fully Processed (Semiprocessed ½c lower)	T-72	T-65	T-58	T-52
BeechBottom, W.Va. W10	15.70	16.30	16.80	17.85
Zanesville, O. A10	15.70	16.30	16.80	17.85
Vandergrift, Pa. U5	15.70	16.30	16.80	17.85

C.R. COILS & CUT LENGTHS (22 Ga.)	Grain Oriented T-100	T-90	T-80	T-73	T-66	T-72
Brackenridge, Pa. A4	18.10	19.70	20.20	20.70	15.70††	
Butler, Pa. A10	....	....	19.70	20.20	20.70	....
Vandergrift, Pa. U5	17.10	18.10	19.70	20.20	20.70	15.70
Warren, O. R2	....	....	....	....	....	15.70‡

*Semiprocessed. †Fully processed only. ‡Coil, annealed; semiprocessed ½c lower. ††Coils only.

WIRE

WIRE, Manufacturers Bright, Low Carbon

AlabamaCity, Ala. R2 ..8.00
Aliquippa, Pa. J5 ...8.00
Alton, Ill. L1 ...8.20
Atlanta A1 ...8.00
Bartonville, Ill. K4 ...8.10
Buffalo W12 ...8.00
Chicago W13 ...8.00
Cleveland A7, C20 ...8.00
Crawfordsville, Ind. M8 ..8.10
Donora, Pa. A7 ...8.00
Duluth A7 ...8.00
Fairfield, Ala. T2 ...8.00
Fostoria, O. (24) S1 ...8.10
Houston S5 ...8.25
Jacksonville, Fla. M8 ...8.35
Johnstown, Pa. B2 ...8.00
Joliet, Ill. A7 ...8.00
KansasCity, Mo. S5 ...8.25
Kokomo, Ind. C16 ...8.10
LosAngeles B3 ...8.95
Minnequa, Colo. C10 ...8.25
Monessen, Pa. P7, P16 ..8.00
Palmer, Mass. W12 ...8.30
Pittsburg, Calif. C11 ...8.95
Portsmouth, O. P12 ...8.00
Rankin, Pa. A7 ...8.00
S. Chicago, Ill. R2 ...8.00
S. SanFrancisco C10 ...8.95
SparrowsPoint, Md. B2 ..8.10
Sterling, Ill. (1) N15 ...8.00
Sterling, Ill. N15 ...8.10
Struthers, O. Y1 ...8.00
Waukegan, Ill. A7 ...8.00
Worcester, Mass. A7 ...8.30

WIRE, Cold Heading Carbon

Elyria, O. W8 ...8.00

WIRE, Gal'd., for ACSR

Bartonville, Ill. K4 ...12.65
Buffalo W12 ...13.40
Cleveland A7 ...12.65
Donora, Pa. A7 ...12.65
Duluth A7 ...12.65
Johnstown, Pa. B2 ...13.40
KansasCity, Mo. U3 ...12.90
Minnequa, Colo. C10 ..12.775
Monessen, Pa. P7, P16..12.65
Muncie, Ind. I-7 ...13.60
NewHaven, Conn. A7 ..12.95
Palmer, Mass. W12 ...13.70
Pittsburg, Calif. C11 ...13.45
Portsmouth, O. P12 ...12.65
Roebling, N.J. R5 ...12.95
SparrowsPt., Md. B2 ...13.50
Struthers, O. Y1 ...13.40
Trenton, N.J. A7 ...12.95
Waukegan, Ill. A7 ...12.65
Worcester, Mass. A7 ...12.95

WIRE, Upholstery Spring

Aliquippa, Pa. J5 ...9.75
Alton, Ill. L1 ...9.95
Buffalo W12 ...9.75
Cleveland A7 ...9.75
Donora, Pa. A7 ...9.75
Duluth A7 ...9.75
Johnstown, Pa. B2 ...9.75
KansasCity, Mo. S5, U3.10.00
Kokomo, Ind. C16 ...9.85
LosAngeles B3 ...10.70
Minnequa, Colo. C10 ...9.95
Monessen, Pa. P7, P16...9.75
NewHaven, Conn. A7 ...10.05
Palmer, Mass. W12 ...10.05
Pittsburg, Calif. C11 ...10.70
Portsmouth, O. P12 ....9.75
Roebling, N.J. R5 ....10.05
S. Chicago, Ill. R2 ....9.75
S. SanFrancisco C10 ...10.70
SparrowsPt., Md. B2 ...9.85
Struthers, O. Y1 ....9.75
Trenton, N.J. A7 ....9.75
Waukegan, Ill. A7 ....9.75
Worcester, Mass. A7 ...10.05

WIRE, MB Spring, High-Carbon

Aliquippa, Pa. J5 ....9.75
Alton, Ill. L1 ....9.95
Bartonville, Ill. K4 ....9.85
Buffalo W12 ....9.75
Cleveland A7 ....9.75
Donora, Pa. A7 ....9.75
Duluth A7 ....9.75
Fostoria, O. S1 ....9.80
Johnstown, Pa. B2 ....9.75
KansasCity, Mo. S5, U3.10.00
LosAngeles B3 ....10.70
Milbury, Mass. (12) N6 .10.05
Minnequa, Colo. C10 ....9.95
Monessen, Pa. P7, P16 ..9.75
Muncie, Ind. I-7 ....9.95
Palmer, Mass. W12 ....10.05
Pittsburg, Calif. C11 ...10.70
Portsmouth, O. P12 ....9.75
Roebling, N.J. R5 ....10.05
S. Chicago, Ill. R2 ....9.75
S. SanFrancisco C10 ...10.70
SparrowsPt., Md. B2 ....9.85
Struthers, O. Y1 ....9.75
Trenton, N.J. A7 ....10.05
Wor'ster, Mass. A7, J4, T6 10.05

WIRE, Fine & Weaving (8" Coils)

Alton, Ill. L1 ....16.50
Bartonville, Ill. K4 ....16.40
Chicago W13 ....16.30
Cleveland A7 ....16.30
Crawfordsville, Ind. M8..16.40
Fostoria, O. S1 ....16.30
Houston S5 ....16.55
Jacksonville, Fla. M8 ..16.65
Johnstown, Pa. B2 ....16.30
KansasCity, Mo. S5 ....16.55
Kokomo, Ind. C16 ....16.30
Minnequa, Colo. C16 ....16.55
Monessen, Pa. P16 ....16.30
Muncie, Ind. I-7 ....16.50
Palmer, Mass. W12 ....16.60
S. SanFrancisco C10 ...17.15
Waukegan, Ill. A7 ....16.30
Worcester, Mass. A7, J6..16.60

ROPE WIRE (A)

Bartonville, Ill. K4 ....13.45
Buffalo W12 ....13.45
Fostoria, O. S1 ....13.45
Johnstown, Pa. B2 ....13.45
Monessen, Pa. P7 ....13.45
Muncie, Ind. I-7 ....13.65
Palmer, Mass. W12 ....13.75
Portsmouth, O. P12 ....13.45
Roebling, N.J. R5 ....13.75
St. Louis L8 ....13.45
SparrowsPt., Md. B2 ...13.55
Struthers, O. Y1 ....13.45
Worcester, Mass. J4 ...13.75

(A) Plow and Mild Plow; add 0.25c for Improved Plow.

WIRE, Tire Bead

Bartonville,Ill. K4	17.15
Monessen,Pa. P16	17.15
Roebling,N.J. R5	17.65

WIRE, Cold-Rolled Flat

Anderson,Ind. G6	12.35
Baltimore T6	12.65
Boston T6	12.65
Buffalo W12	12.35
Chicago W13	12.45
Cleveland A7	12.35
Crawfordsville,Ind. M8	12.35
Dover,O. G6	12.35
Evanston,Ill. M22	12.45
Farrell,Pa. S3	12.35
Fostoria,O. S1	12.35
FranklinPark,Ill. T6	12.45
Kokomo,Ind. C16	12.35
Massillon,O. R8	12.35
Milwaukee C23	12.55
Monessen,Pa. P7, P16	12.35
NewCastle,Pa. M23	12.35
Palmer,Mass. W12	12.65
Pawtucket,R.I. NS	12.65
Philadelphia P24	12.65
Riverdale,Ill. A1	12.45
Rome,N.Y. R6	12.35
Sharon,Pa. S3	12.35
Trenton,N.J. R5	12.65
Warren,O. B9	12.35
Worcester,Mass. A7,T6	12.65

NAILS, Stock Sizes — Col.

AlabamaCity,Ala. R2	173
Aliquippa,Pa. J5	173
Atlanta A11	173
Bartonville,Ill. K4	175
Chicago W13	173
Cleveland A9	173
Crawfordsville,Ind. M8	175
Donora,Pa. A7	173
Duluth A7	173
Fairfield,Ala. T2	173
Houston S5	178
Jacksonville,Fla. M8	175
Johnstown,Pa. B2	173
Joliet,Ill. A7	173
KansasCity,Mo. S5	178
Kokomo,Ind. C16	175
Minnequa,Colo. C10	178
Monessen,Pa. P7	173
Pittsburg,Calif. C11	192
Rankin,Pa. A7	173
S.Chicago,Ill. R2	173
SparrowsPt.,Md. B2	175
Sterling,Ill.(7) N15	175
Worcester,Mass. A7	179

(To Wholesalers: per cwt)

Galveston,Tex. D7	$10.30

NAILS, CUT (100 lb kegs)

Wheeling,W.Va. W10	$10.10

POLISHED STAPLES — Col.

AlabamaCity,Ala. R2	175
Aliquippa,Pa. J5	173
Atlanta A11	173
Bartonville,Ill. K4	175
Crawfordsville,Ind. M8	177
Donora,Pa. A7	173
Duluth A7	173
Fairfield,Ala. T2	173
Houston S5	180
Jacksonville,Fla. M8	177
Johnstown,Pa. B2	175
Joliet,Ill. A7	173
KansasCity,Mo. S5	180
Kokomo,Ind. C16	177
Minnequa,Colo. C10	178
Pittsburg,Calif. C11	194
Rankin,Pa. A7	173
S.Chicago,Ill. R2	175
SparrowsPt.,Md. B2	177
Sterling,Ill.(7) N15	175
Worcester,Mass. A7	179

TIE WIRE, Automatic Baler (14½ Ga.) (per 97 lb Net Box) Coil No. 3150

AlabamaCity,Ala. R2	$8.78
Atlanta A11	10.36
Bartonville,Ill. K4	8.88
Buffalo W12	10.26
Chicago W13	9.24
Crawfordsville,Ind. M8	8.88
Donora,Pa. A7	8.78
Duluth A7	8.78
Fairfield,Ala. T2	8.78
Houston S5	10.51
Jacksonville,Fla. M8	8.88
Johnstown,Pa. B2	8.78
Joliet,Ill. A7	8.78
KansasCity,Mo. S5	10.51
Kokomo,Ind. C16	8.88
LosAngeles B3	9.44
Minnequa,Colo. C10	9.02
Pittsburg,Calif. C11	9.44
S.Chicago,Ill. R2	8.78
S.SanFrancisco C10	9.94
SparrowsPt.,Md. B2	8.88
Sterling,Ill.(37) N15	8.88

Coil No. 6500 Stand.

AlabamaCity,Ala. R2	$9.06
Atlanta A11	10.70
Bartonville,Ill. K4	9.16
Buffalo W12	10.60
Chicago W13	9.54
Crawfordsville,Ind. M8	9.16
Donora,Pa. A7	9.06
Duluth A7	9.06
Fairfield,Ala. T2	9.06
Houston S5	10.85
Jacksonville,Fla. M8	9.16
Johnstown,Pa. B2	9.06
Joliet,Ill. A7	9.06
KansasCity,Mo. S5	10.85
Kokomo,Ind. C16	9.16
LosAngeles B3	9.75
Minnequa,Colo. C10	9.30
Pittsburg,Calif. C11	9.75
S.Chicago,Ill. R2	9.06
S.SanFrancisco C10	10.26
SparrowsPt.,Md. B2	9.16
Sterling,Ill.(37) N15	9.16

Coil No. 6500 Interim

AlabamaCity,Ala. R2	$9.11
Atlanta A11	10.75
Bartonville,Ill. K4	9.21
Buffalo W12	10.65
Chicago W13	9.59
Crawfordsville,Ind. M8	9.21
Donora,Pa. A7	9.11
Duluth A7	9.11
Fairfield,Ala. T2	9.11
Houston S5	10.90
Jacksonville,Fla. M8	9.21
Johnstown,Pa. B2	9.11
Joliet,Ill. A7	9.11
KansasCity,Mo. S5	10.96
Kokomo,Ind. C16	9.21
LosAngeles B3	9.80
Minnequa,Colo. C10	9.35
Pittsburg,Calif. C11	9.80
S.Chicago,Ill. R2	9.11
S.SanFrancisco C10	10.31
SparrowsPt.,Md. B2	9.21
Sterling,Ill.(37) N15	9.21

BALE TIES, Single Loop — Col.

AlabamaCity,Ala. R2	212
Atlanta A11	212
Bartonville,Ill. K4	214
Crawfordsville,Ind. M8	214
Donora,Pa. A7	212
Duluth A7	212
Fairfield,Ala. T2	212
Houston S5	217
Jacksonville,Fla. M8	214
Joliet,Ill. A7	212
KansasCity,Mo. S5	217
Kokomo,Ind. C16	214
Minnequa,Colo. C10	217
SparrowsPt.,Md. B2	214
Sterling,Ill.(7) N15	214

FENCE POSTS — Col.

Birmingham C15	177
ChicagoHts.,Ill. C2, I-2	177
Duluth A7	177
Franklin,Pa. F5	177
Johnstown,Pa. B2	177
Marion,O. P11	177
Minnequa,Colo. C10	182
Tonawanda,N.Y. B12	177

WIRE, Barbed — Col.

AlabamaCity,Ala. R2	193**
Aliquippa,Pa. J5	190§
Atlanta A11	197*
Bartonville,Ill. K4	199
Crawfordsville,Ind. M8	198
Donora,Pa. A7	193†
Duluth A7	193†
Fairfield,Ala. T2	193†
Houston S5	198**
Jacksonville,Fla. M8	198
Johnstown,Pa. B2	196§
Joliet,Ill. A7	193†
KansasCity,Mo. S5	198**
Kokomo,Ind. C16	195†
Minnequa,Colo. C10	198**
Monessen,Pa. P7	196§
Pittsburg,Calif. C11	213†
Rankin,Pa. A7	193†
S.Chicago,Ill. R2	193**
SparrowsPoint,Md. B2	198§
Sterling,Ill.(7) N15	198

WIRE (16 gage)	An'ld Stone	Galv. Stone
Ala.City,Ala.R2	17.85	19.40**
Ali'ppa,Pa. J5	17.85	19.65
Bartonville K4	17.95	19.80
Chicago W13	17.85	....
Cleveland A7	17.85	....
Craw'sville M8	17.95	19.80‡‡
Fostoria,O. S1	18.35	19.90†
Houston S5	18.10	19.65**
Jacksonville M8	18.95	19.80‡‡
Johnstown B2	17.85	19.65§
Kan.City,Mo. S5	18.10	....
Kokomo C16	17.95	19.50†
Minnequa C10	18.10	19.65**
P'lm'r,Mass.W12	18.15	19.70†
Pitts.,Calif. C11	18.20	19.75†
S.SanFran. C10	18.20	19.75**
St'ling(37) N15	17.95	19.80
SparrowsPt. B2	17.95	19.75§
Waukegan A7	17.85	19.40†
Worcester A7	18.15	....

WOVEN FENCE, 9-15 Ga. Col.

Ala.City,Ala. R2	187**
Aliq'ppa,Pa.9-11½ga.J5	190§
Atlanta A11	191*
Bartonville,Ill. K4	193
Crawfordsville,Ind. M8	192
Donora,Pa. A7	187†
Duluth A7	187†
Fairfield,Ala. T2	187†
Houston S5	192**
Jacksonville,Fla. M8	192
Johnstown,Pa.(42) B2	190§
Joliet,Ill. A7	187†
KansasCity,Mo. S5	192**
Kokomo,Ind. C16	189†
Minnequa,Colo. C10	192**
Pittsburg,Calif. C11	210†
Rankin,Pa. A1	187†
S.Chicago,Ill. R2	187**
Sterling,Ill.(7) N15	192

WIRE, Merchant Quality (6 to 8 gage)	An'ld Galv.
Ala.City,Ala. R2	9.00 9.55**
Aliquippa J5	8.65 9.25§
Atlanta(48) A11	9.00 9.75*
Bartonville(48)K4	9.85 19.90
Buffalo W12	9.00 9.55†
Chicago W13	9.00 9.55**
Cleveland A7	9.00 ....
Crawfordsville M8	9.10 9.80††
Donora,Pa. A7	9.00 9.55†
Duluth A7	9.00 9.55†
Fairfield T2	9.00 9.55†
Houston(48) S5	9.25 9.80**
Jack'ville,Fla. M8	9.10 9.80‡‡
Johnstown(48) B2	9.00 9.675§
Joliet,Ill. A7	9.00 9.55†
KansasCity(48)S5	9.25 9.80**
Kokomo(48) S16	9.10 9.65†
LosAngeles B3	9.95 10.625§
Minnequa C10	9.25 9.80**
Monessen(48) P7	8.65 9.35§
Palmer,Mass. W12	9.30 9.85†
Pitts.,Calif. C11	9.95 10.50†
Rankin,Pa. A7	9.00 9.55†
S.Chicago R2	9.00 9.55**
S.SanFran. C10	9.95 10.50**
Spar'wsPt.(48)B2	9.10 9.775§
St'ling(37)(48)N15	9.10 9.80
Struthers,O. Y1	9.00 9.65‡
Worcester,Mass.A7	9.30 9.85†

Based on zinc prices of: *13.50c. †5c. §10c. Less than 10c. ††10.50c. ‡‡11.00c. **Subject to zinc equalization extras.

RIVETS

F.o.b. Cleveland and/or freight equalized with Pittsburgh, f.o.b. Chicago and/or freight equalized with Birmingham except where equalization is too great.

Structural ½ in., larger 12.85

⅞ in. and smaller by 6 in. and shorter: 15% off list.

FASTENERS

(Consumer discounts per cent off list prices, orders for 1 container for assorted sizes; for less than container quantities, add 25 per cent; attaching nuts to bolts, package sizes, add 7.5 per cent; heavy hex nut 1⅛ in. through 1½ in. tapped 8 threads, add 10 per cent)

HEX HEAD CAP SCREWS, coarse, or fine thread, packaged or bulk, with or without hex nuts, 1020 steel bright and high carbon heat treated, ¼ in. thru 1 in. diam., listed lengths:

Plain Finish	50
Hot Galvanized and Zinc Plated:	
Packaged	43.75
Bulk	50

BOLTS, Standard stock sizes:

Plain Finish	50
Hot Galvanized and Zinc Plated:	
Packaged	43.75
*Bulk	50

*Hot galvanized or zinc plated lag bolts only — for package or bulk quantities use applicable list less bulk discounts.

CAP AND SETSCREWS,

Fillister Head, Cap Screws, Coarse Thread:

Packaged	+55
Bulk	+16

Flat Head Cap Screws: ¾ in. and smaller, 6 in. and shorter:

Packaged	+85
Bulk	+38

Setscrews, Square Head, Cup Point, Coarse Thread: Through 1 in. diam., 6 in. and shorter:

Packaged	+ 5
Bulk	19

Through 1 in. diam., longer than 6 in.:

Packaged	+29

HEXAGON NUTS, American Standard: Finished hex, hex jam, and hex slotted coarse or fine thread, ¼ in. through 3 in., finished hex thick, thick and slotted castle, fine thread, ¼ in. through 1½ in., semifinished hex heavy, heavy and jam, heavy and slotted, coarse thread, ¼ in. through 4 in., and

SQUARE NUTS, American Standard: Regular square and heavy square, coase thread, ¼ in. through 2 in.:

Plain Finish	50
Hot Galvanized and Zinc Plated:	
Packaged	43.75
Bulk	50

PRESTRESSED STRAND

(High strength, stress relieved; 7 wire uncoated. Net prices per 1000 ft, 40,000 lb and over)

	Standard Diameter, Inches				
	1/4	5/16	3/8	7/16	1/2
Buffalo W12	$26.20	$38.50	$47.90	$61.30	$80.30
KansasCity,Mo. U3	26.20	38.50	47.90	61.30	80.30
Minnequa,Colo. C10	26.20	38.50	47.90	61.30	80.30
Pittsburg,Calif. C11	26.20	38.50	47.90	61.30	80.30
Roebling,N.J. R5	26.20	38.50	47.90	61.30	80.30
SparrowsPoint,Md. B2	26.20	38.50	47.90	61.30	80.30
St.Louis L8	26.20	38.50	47.90	61.30	80.30
Waukegan,Ill. A7	26.20	38.50	47.90	61.30	80.30

BOILER TUBES

Net base c.l. prices, dollars per 100 ft, mill; minimum wall thickness, cut length 10 to 24 ft, inclusive.

O.D. In.	B.W. Gage	Seamless H.R.	Seamless C.D.	Elec. Weld H.R.
1	13	....	27.24	23.13
1¼	13	....	32.25	24.41
1½	13	30.42	35.65	26.98
1¾	13	35.94	42.12	31.89
2	13	40.28	47.21	35.74
2¼	13	45.36	53.17	40.26
2¼	12	49.24	57.72	43.70
2½	12	54.23	63.57	48.13
2¾	12	58.73	68.83	52.13
3	12	62.62	73.40	55.59

RAILWAY MATERIALS

Rails	Standard No. 1	Standard No. 2	All No. 2	Tee Rails 60 lb Under
Bessemer,Pa. U5	5.75	5.65	....	6.725
Ensley,Ala. T2	5.75	5.65	....	6.725
Fairfield,Ala. T2	....	....	....	6.725
Gary,Ind. U5	5.75	5.65	....	....
Huntington,W.Va. C15	....	....	....	6.725
Johnstown,Pa. B2	....	....	....(16)	6.725
Lackawanna,N.Y. B2	5.75	5.65	....	6.725
Minnequa,Colo. C10	5.75	5.65	....	7.225
Steelton,Pa. B2	5.75	5.65	....	....
Williamsport,Pa. S19	....	....	....	6.725

TIE PLATES

Fairfield,Ala. T2	6.875
Gary,Ind. U5	6.875
Lackawanna,N.Y. B2	6.875
Minnequa,Colo. C10	6.875
Seattle B3	7.025
Steelton,Pa. B2	6.875
Torrance,Calif. C11	7.025

JOINT BARS

Bessemer,Pa. U5	7.25
Fairfield,Ala. T2	7.25
Joliet,Ill. U5	7.25
Lackawanna,N.Y. B2	7.25
Minnequa,Colo. C10	7.25
Steelton,Pa. B2	7.25

AXLES

Ind.Harbor,Ind. S13	9.125
Johnstown,Pa. B2	9.125

SCREW SPIKES

Lebanon,Pa. B2	15.10

TRACK BOLTS, Untreated

Cleveland R2	15.35
KansasCity,Mo. S5	15.35
Lebanon,Pa. B2	15.35
Minnequa,Colo. C10	15.35
Pittsburgh S44	15.35
Seattle B3	15.85

STANDARD TRACK SPIKES

Fairfield,Ala. T2	10.10
Ind.Harbor,Ind. I-2, Y1	10.10
KansasCity,Mo. S5	10.10
Lebanon,Pa. B2	10.10
Minnequa,Colo. C10	10.10
Pittsburgh J5	10.10
Seattle B3	10.60
S.Chicago,Ill. R2	10.10
Struthers,O. Y1	10.10
Youngstown R2	10.10

Footnotes

(1) Chicago base.
(3) Merchant.
(4) Reinforcing.
(5) 1⅛ to under 1 7/16 in.; 1 7/16 to under 1 15/16 in.; 6.70c; 1 15/16 to 8 in., inclusive, 7.05c.
(6) Limited analyses only.
(7) Chicago base 2 cols. lower.
(8) 16 Ga. and heavier.
(9) Merchant quality; add 0.35c for special quality.
(12) Worcester, Mass., base.
(15) ⅝" and thinner.
(16) 40 lb and under.
(17) Flats only; 0.25 in. & heavier.
(23) Special quality.
(24) Deduct 0.05c, finer than 15 Ga.
(25) Bar mill bands.
(26) Deld. in mill zone, 5.65c.
(27) Bar mill sizes.
(28) Bonderized.
(30) Sheared; for universal mill add 0.45c.
(31) Widths over ⅝ in.; 7.375c, for widths ⅝ in. and under by 0.125 in. and thinner.
(32) Buffalo base.
(33) 14 Ga., 48 in.
(35) 72" and narrower.
(36) 54" and narrower.
(37) Chicago base, 10 points lower.
(38) 13 Ga. & lighter; 60" & narrower.
(39) 48" and narrower.
(43) 9-14½ Ga.
(44) To fabricators.
(48) 6-7 Ga.
(49) 3½ in. and smaller rounds and 2½ in. and smaller hexagons; 9.65c for larger rounds and hexagons and other shapes.

Strong Restraining Influences...

Roebling Hose Reinforcing Wire

Roebling Hose Wire, Hose Reinforcing Wire and Hose Wrapping Wire bear the stamp of Roebling's strict attention to constant uniformity. As with all Roebling wire products, each is wholly Roebling-made and Roebling-controlled, from open hearth to packaging. Tensile strength and forming qualities, finish and gage are of an excellence that proves itself in use.

Resistance to internal and external pressures and wear are what you look for in hose wires and what you pay for. With Roebling, you *get* them.

For further information on these and other Roebling quality products, write or call Roebling's, Wire and Cold Rolled Steel Products Division, Trenton 2, New Jersey.

Roebling... Your Product is better for it

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

ELIMINATE UNNECESSARY ASSEMBLY COSTS with

Replace improvised units with readily available precision cam followers.

McGILL®

CAMROL® BEARINGS

CF (Cam Follower) SERIES

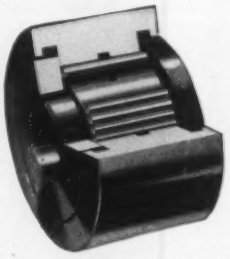
The original and still unsurpassed anti-friction roller bearing cam-follower bearing that adds efficiency at less cost to cam actuated, track and support roller applications. Built with full roller complement and integral stud, the CF series design provides high radial capacity and shock load protection in a compact roller with its own shaft. Easily applied and available in roller diameters of ½" to 4".

for the ultimate in:

- RADIAL CAPACITY
- SHOCK RESISTANCE
- SPACE ECONOMY

SCF SERIES.

Sealed to keep contamination out and lubricant in. It is dimensionally interchangeable with the CF bearings. A turned groove in the center of the outer raceway bore provides a permanent lubricant reservoir to approach life-time lubrication requirements. Can be easily re-lubricated.



SCYR SERIES
(sealed)

CYR (Cam Yoke Roller) SERIES

The CYR series increases the adaptability of the CF bearing to all types of automatic machinery involving cam action or controlled-motion machine parts that require guide or support rollers. An inner ring replaces the stud for cam yoke roller mountings.

Write for Catalog No. 52-A for full information on McGill's needle roller bearings, and cam followers. Ask about recommendations for high precision special ball and roller bearings.

SCYR SERIES

This series provides a fully sealed Cam Yoke Roller type bearing. It is dimensionally interchangeable with the CYR bearings.

McGILL MANUFACTURING CO., INC., Bearing Division
301 N. Lafayette Street, Valparaiso, Indiana

engineered electrical products

McGILL®

precision needle roller bearings

SEAMLESS STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Size—Inches	2		2½		3		3½		4		5		6	
List Per Ft	37c		58.5c		76.5c		92c		$1.09		$1.48		$1.92	
Pounds Per Ft	8.68		5.82		7.62		9.20		10.89		14.81		19.18	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	+12.25	+28.75	+5.75	+23.5	+3.25	+21	+1.75	+19.5	+1.75	+19.5	+2	+19.75	0.5	+17.25
Ambridge, Pa. N2	+12.25	....	+5.75	....	+3.25	....	+1.75	....	+1.75	....	+2	....	0.5	....
Lorain, O. N3	+12.25	+28.75	+5.75	+23.5	+3.25	+21	+1.75	+19.5	+1.75	+19.5	+2	+19.75	0.5	+17.25
Youngstown Y1	+12.25	+28.75	+5.75	+23.5	+3.25	+21	+1.75	+19.5	+1.75	+19.5	+2	+19.75	0.5	+17.25

ELECTRICWELD STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Youngstown R2	+12.25	+28.75	+5.75	+23.5	+3.25	+21	+1.75	+19.5	+1.75	+19.5	+2	+19.75	0.5	+17.25

BUTTWELD STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Size—Inches	⅛		¼		⅜		½		¾		1		1¼	
List Per Ft	5.5c		6c		6c		8.5c		11.5c		17c		23c	
Pounds Per Ft	0.24		0.42		0.57		0.85		1.13		1.68		2.28	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Alton, Ill. L1	....	....	....	....	....	....	0.25	+17	3.25	+13	6.75	+8.5	9.25	+7.25
Benwood, W. Va. W10	1.5	+27	+10.5	+36	+21	+45.5	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Butler, Pa. F6	4.5	+24	+8.5	+34	+19.5	+44	....	....	....	....	....	....	....	....
Etna, Pa. N2	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Fairless, Pa. N3	....	....	....	....	....	....	0.25	+17	3.25	+13	6.75	+8.5	9.25	+7.25
Fontana, Calif. K1	....	....	....	....	....	....	+10.75	+28	+7.75	+24	+4.25	+19.5	+1.75	+18.25
Indiana Harbor, Ind. Y1	....	....	....	....	....	....	1.25	+16	4.25	+12	7.75	+7.5	10.25	+6.25
Lorain, O. N3	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Sharon, Pa. S4	4.5	+24	+8.5	+34	+19.5	+44	....	....	....	....	....	....	....	....
Sharon, Pa. M6	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Sparrows Pt., Md. B2	2.5	+26	+10.5	+36	+21.5	+46	0.25	+17	3.25	+13	6.75	+8.5	9.25	+7.25
Wheatland, Pa. W9	4.5	+24	+8.5	+34	+19.5	+44	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Youngstown R2, Y1	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25

Size—Inches	1½		2		2½		3		3½		4	
List Per Ft	27.5c		37c		58.5c		76.5c		92c		$1.09	
Pounds Per Ft	2.75		3.68		5.82		7.62		9.20		10.89	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5
Alton, Ill. L1	9.75	+6.25	10.25	+5.75	11.75	+5.5	11.75	+5.5	1.25	+16.5	1.25	+16.5
Benwood, W. Va. W10	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5
Etna, Pa. N2	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5
Fairless, Pa. N3	9.75	+6.25	10.25	+5.75	11.75	+5.5	11.75	+5.5	1.25	+16.5	1.25	+16.5
Fontana, Calif. K1	+1.25	+17.25	+0.75	+16.75	0.75	+16.5	0.75	+16.5	+9.75	+27.5	+9.75	+27.5
Indiana Harbor, Ind. Y1	10.75	+5.25	11.25	+4.75	12.75	+4.5	12.75	+4.5	2.25	+15.5	2.25	+15.5
Lorain, O. N3	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	....	....	....	....
Sharon, Pa. M6	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	....	....	....	....
Sparrows Pt., Md. B2	9.75	+6.25	10.25	+5.75	11.75	+5.5	11.75	+5.5	1.25	+16.5	1.25	+16.5
Wheatland, Pa. W9	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5
Youngstown R2, Y1	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5

*Galvanized pipe discounts based on price of zinc at 13.00c, East St. Louis.

Stainless Steel

Representative prices, cents per pound; subject to current lists of extras

AISI Type	—Rerolling— Ingot	Slabs	Forging Billets	H.R. Strip	H.R. Rods; C.F. Wire	Bars; Structural Shapes	Plates	Sheets	C.R. Strip; Flat Wire
201	22.75	25.00	....	36.00	....	43.50	39.25	48.50	45.00
202	24.75	28.25	37.75	39.00	42.25	44.50	40.00	49.25	49.25
301	24.00	26.00	38.75	37.25	43.50	46.00	41.25	51.25	47.50
302	26.25	29.50	39.50	40.50	44.25	46.75	42.25	52.00	52.00
302B	26.50	30.75	42.25	45.75	46.75	49.00	44.50	57.00	57.00
303	....	33.25	42.50	....	47.25	49.75	45.00	56.75	56.75
304	28.00	29.50	39.50	40.50	44.25	46.75	45.75	52.00	52.00
304L	....	37.25	47.25	48.25	52.00	54.50	53.50	59.75	59.75
305	29.50	34.75	44.00	47.50	47.00	49.50	46.25	58.75	58.75
308	32.00	36.25	49.00	50.25	54.75	57.75	55.25	63.00	63.00
309	41.25	47.50	60.00	64.50	66.25	69.50	66.00	80.50	80.50
310	51.50	59.50	81.00	84.25	89.75	94.50	87.75	96.75	96.75
314	....	....	80.50	....	89.75	94.50	87.75	....	104.25
316	41.25	47.50	64.50	68.50	71.75	75.75	71.75	80.75	80.75
316L	....	55.25	72.25	76.25	79.50	83.50	79.50	88.50	88.50
317	49.75	58.00	79.75	88.25	89.50	94.25	88.50	101.00	101.00
321	33.50	38.00	48.75	53.50	54.50	57.50	54.75	65.50	65.50
330	....	....	123.25	....	98.75	143.75	135.00	149.25	149.25
18-8 CbTa	38.50	48.25	57.75	63.50	63.75	67.25	64.75	79.25	79.25
403	....	....	29.25	....	33.25	35.00	30.00	40.25	40.25
405	20.25	26.50	30.75	36.00	34.75	36.50	32.50	46.75	46.75
410	17.50	19.50	29.25	31.00	33.25	35.00	30.00	40.25	40.25
416	....	....	29.75	....	33.75	35.50	31.25	48.25	48.25
420	....	31.50	35.50	41.75	40.75	42.75	40.25	62.00	62.00
430	17.75	19.75	29.75	32.00	33.75	35.50	31.00	40.75	40.75
430F	....	....	30.50	....	34.25	36.00	31.75	51.75	51.75
431	....	29.75	39.25	....	43.50	46.00	41.00	56.00	56.00
446	....	....	40.75	59.00	46.00	48.25	42.75	70.00	70.00

Producers Are: Allegheny Ludlum Steel Corp.; American Steel & Wire Div., U. S. Steel Corp.; Anchor Drawn Steel Co., division of Vanadium-Alloys Steel Co.; Armco Steel Corp.; Babcock & Wilcox Co.; Bethlehem Steel Co.; J. Bishop & Co.; A. M. Byers Co.; Calstrip Steel Corp.; G. O. Carlson Inc.; Carpenter Steel Co.; Carpenter Steel Co. of New England; Charter Wire Products; Crucible Steel Co. of America; Damascus Tube Co.; Dearborn Div., Sharon Steel Corp.; Wilbur B. Driver Co.; Driver-Harris Co.; Eastern Stainless Steel Corp.; Firth Sterling Inc.; Fort Wayne Metals Inc.; Green River Steel Corp., subsidiary of Jessop Steel Co.; Indiana Steel & Wire Co.; Ingersoll Steel Div., Borg-Warner Corp.; Ellwood Ivins Steel Tube Works Inc.; Jessop Steel Co.; Johnson Steel & Wire Co. Inc.; Stainless & Strip Div., Jones & Laughlin Steel Corp.; Joslyn Stainless Steels, division of Joslyn Mfg. & Supply Co.; Latrobe Steel Co.; Lukens Steel Co.; Maryland Fine & Specialty Wire Co. Inc.; McLouth Steel Corp.; Metal Forming Corp.; Midvale-Heppenstall Co.; National Standard Co.; National Tube Div., U. S. Steel Corp.; Pacific Tube Co.; Page Steel & Wire Div., American Chain & Cable Co. Inc.; Pittsburgh Rolling Mills Inc.; Republic Steel Corp.; Riverside-Alloy Metal Div., H. K. Porter Company Inc.; Rodney Metals Inc.; Sawhill Tubular Products Inc.; Sharon Steel Corp.; Simonds Saw & Steel Co.; Somers Brass Co.; Specialty Wire Co. Inc.; Standard Tube Co.; Superior Steel Div., Copperweld Steel Co.; Superior Tube Co.; Swepco Tube Corp.; Techalloy Co. Inc.; Timken Roller Bearing Co.; Trent Tube Co., subsidiary of Crucible Steel Co. of America; Tube Methods Inc.; Ulbrich Stainless Steel Inc.; Union Steel Corp.; U. S. Steel Corp.; Universal Cyclops Steel Corp.; Vanadium-Alloys Steel Co.; Wall Tube & Metal Products Co.; Wallingford Steel, subsidiary of Allegheny Ludlum Steel Corp.; Washington Steel Corp.; Seymour Mfg. Co.

Clad Steel

	Plates 5%	Plates Carbon Base 10%	Plates Carbon Base 15%	Plates Carbon Base 20%	Sheets Carbon Base 20%
Stainless					
302	....	....	....	....	37.50
304	26.05	28.80	31.55	34.30	39.75
304L	30.50	33.75	36.95	40.15	....
316	38.20	42.20	46.25	50.25	58.25
316L	42.30	46.75	51.20	55.65	....
316 Cb	49.90	55.15	60.40	65.65	....
321	31.20	34.50	37.75	41.05	47.25
347	36.90	40.80	44.65	48.55	57.00
405	22.25	24.60	26.90	29.25	....
410	20.55	22.70	24.85	27.00	....
430	21.20	23.45	25.65	27.90	....
Inconel	49.80	61.35	72.80	84.40	....
Nickel	43.20	55.05	66.95	78.90	....
Nickel, Low Carbon	43.50	55.70	67.95	80.35	....
Monel	44.25	55.35	66.45	77.60	....

	Strip, Carbon Base —Cold Rolled— 10%	Both Sides
Copper*	36.35	43.40

*Deoxidized. Production points: Stainless-clad sheets, New Castle, Ind. I-4; stainless-clad plates, Claymont, Del. P4; Coatesville, Pa. L7; New Castle, Ind. I-4, and Washington, Pa. J3; nickel, inconel, monel-clad plates, Coatesville L7; copper-clad strip, Carnegie, Pa. S18.

Tool Steel

Grade	$ per lb	Grade	$ per lb
Reg. Carbon (W-1)	0.330	Hi-Carbon-Cr (D-11)	0.955
Spec. Carbon (W-1)	0.385	V-Cr Hot Work (H-13)	0.550
Oil Hardening (O-1)	0.505	W-Cr Hot Work (H-12)	0.530
V-Cr Hot Work (H-11)	0.505	W Hot Wk (H-21)	1.425-1.44

Grade by Analysis (%) W	Cr	V	Co	Mo	AISI Designation	$ per lb
18	4	1	....	....	T-1	1.840
18	4	2	....	....	T-2	2.005
13.5	4	3	....	....	T-3	2.105
18.25	4.25	1	4.75	....	T-4	2.545
18	4	2	9	....	T-5	2.915
20.25	4.25	1.6	12.95	....	T-6	4.330
13.75	3.75	2	5	....	T-8	2.485
1.5	4	1	....	8.5	M-1	1.200
6.4	4.5	1.9	....	5	M-2	1.345
6	4	3	....	6	M-3	1.590

Tool steel producers include: A4, A8, B2, B8, C4, C9, C12, C18, F2, J3, L3, M14, S8, U4, V2, and V3.

Pig Iron

Prices in dollars per gross ton, f.o.b. (rail) furnace; add 50 cents when shipped by truck. Maximum delivered prices are approximate and based on rail shipment.

Birmingham District	Basic	No. 2 Foundry	Malle-able	Besse-mer
Birmingham R2	62.00	62.50**	66.50	....
Birmingham U6	....	62.50**	66.50	....
Woodward, Ala. W15	62.00*	62.50**	66.50	....
Cincinnati, deld.	....	70.20	....	....
Buffalo District				
Buffalo H1, R2	66.00	66.50	67.00	67.50
N. Tonawanda, N.Y. T9	....	66.50	67.00	67.50
Tonawanda, N.Y. W12	66.00	66.50	67.00	67.50
Boston, deld.	77.29	77.79	78.29	....
Rochester, N.Y., deld.	69.02	69.52	70.02	....
Syracuse, N.Y., deld.	70.12	70.62	71.12	....
Chicago District				
Chicago I-3	66.00	66.50	66.50	67.00
S. Chicago R2	66.00	66.50	66.50	67.00
S. Chicago, Ill. W14	66.00	....	66.50	67.00
Milwaukee, deld.	68.81	69.31	69.31	69.81
Muskegon, Mich., deld.	....	74.46	74.46	....
Cleveland District				
Cleveland R2, A7	66.00	66.50	66.50	67.00
Akron, Ohio, deld.	69.52	70.02	70.02	70.52
Mid-Atlantic District				
Birdsboro, Pa. B10	68.00	68.50	69.00	69.50
Chester, Pa. P4	Nom.	Nom.	Nom.	....
Swedeland, Pa. A3	68.00	68.50	69.00	69.50
New York, deld.	....	73.41	73.91	....
Newark, N.J., deld.	72.53	73.03	73.53	74.03
Philadelphia, deld.	70.18	70.68	71.18	71.68
Troy, N.Y., R2	68.00	68.50	69.00	69.50
Boston, deld.	75.20	75.70	76.20	76.70
Pittsburgh District				
Neville Island, Pa. P8	66.00	66.50	66.50	67.00
Pittsburgh (N&S sides), deld.	....	68.31	68.31	68.81
Monaca, Pa., deld.	....	68.33	68.33	68.83
Lawrenceville, W. Homestead, Wilmerding, Pa., deld.	....	68.68	68.68	69.18
Verona, Trafford, Pa., deld.	68.83	69.33	69.33	69.83
Brackenridge, Pa., deld.	69.16	69.66	69.66	70.16
Midland, Pa. C18	66.00	....	....	....
Youngstown District				
Hubbard, Ohio Y1	....	....	66.50	....
Sharpsville, Pa. S6	66.00	....	66.50	67.00
Youngstown Y1	....	....	66.50	....

Other U. S. Districts	Basic	No. 2 Foundry	Malle-able	Besse-mer
Duluth I-3	66.00	66.50	66.50	67.00
Erie, Pa. I-3	66.00	66.50	66.50	67.00
Fontana, Calif. K1	75.00	75.50	....	....
Geneva, Utah C11	66.00	66.50	....	....
GraniteCity, Ill. G4	67.90	68.40	68.90	....
Ironton, Utah C11	66.00	66.50	....	....
Minnequa, Colo. C10	68.00	68.50	69.00	....
Rockwood, Tenn. T3	62.00	62.50‡	66.50	67.00
Toledo, Ohio I-3	66.00	66.50	66.50	67.00
Cincinnati, deld.	72.94	73.44	....	....
Mansfield, Ohio, deld.	....	....	71.34	....
Canadian District				
Hamilton, Ont. S46	65.00	65.00	65.50	....
PortColborne, Ont. A25	65.00	65.00	65.50	66.00
SaultSte. Marie, Ont. A25	65.00	65.00	65.50	66.00

*Phos. 0.70-0.90%; Phos. 0.30-0.69%, $63.
**Phos. 0.70-0.90%; Phos. 0.30-0.69%, $63.50.
‡Phos. 0.50% up; Phos. 0.30-0.49%, $63.50.

PIG IRON DIFFERENTIALS

Silicon: Add 75 cents per ton for each 0.25% Si or percentage thereof over base grade, 1.75-2.25%, except on low phos. iron on which base is 1.75-2.00%.

Manganese: Add 50 cents per ton for each 0.25% manganese over 1% or portion thereof.

BLAST FURNACE SILVERY PIG IRON, Gross Ton

(Base 6.01-6.50% silicon; add 75c for each 0.50% silicon or portion thereof over the base grade within a range of 6.50 to 11.50%; starting with silicon over 11.50% add $1.50 per ton for each 0.50% silicon or portion thereof up to 14%; add $1 for each 0.50% Mn over 1%)

Buffalo H1	$79.25
Jackson, Ohio I-3, J1	78.00
PortColborne, Ont. A25	78.50

ELECTRIC FURNACE SILVERY IRON, Gross Ton

(Base 14.01-14.50% silicon; add $1 for each 0.5% Si to 18%; $1.25 for each 0.50% Mn over 1%; $2 per gross ton premium for 0.045% max P)

CalvertCity, Ky. P15	$99.00
NiagaraFalls, N.Y. P15	99.00
Keokuk, Iowa Open-hearth & Fdry. K2	89.00
Keokuk, Iowa O.H. & Fdry, 12½ lb piglets, 16% Si, K2	92.00

LOW PHOSPHORUS PIG IRON, Gross Ton

Birdsboro, Pa. B10 (Phos. 0.075% max)	$73.00
Lyles, Tenn. T3 (Phos. 0.035% max)	73.00
Rockwood, Tenn. T3 (Phos. 0.035% max)	73.00
Buffalo H1 (Intermediate) (0.036-0.075% max)	71.50
Cleveland A7 (Intermediate) (Phos. 0.036-0.075% max)	71.00
Duluth I-3 (Intermediate) (Phos. 0.036-0.075% max)	71.00
Erie, Pa. I-3 (Intermediate) (Phos. 0.036-0.075% max)	71.00
Neville Island, Pa. P6 (Intermediate) (Phos. 0.036-0.075% max)	71.00
Swedeland, Pa. A3 (Intermediate) (Phos. 0.036-0.075% max)	73.00
Troy, N.Y. R2 (Phos. 0.075% max)	73.00

Steel Service Center Products

Representative prices, cents per pound, f.o.b. warehouse, for 2000 lb items (except stainless) ordered by themselves. Prices will vary with total weight of the order or weight of the individual items or both. Base quantities for stainless sheets: 8000 lb, except in Chicago, New York, Boston, Los Angeles, and San Francisco, 10,000 lb. City delivery charges are 15 cents per 100 lb except: Denver, 20 cents; Baltimore, Boston, New York, Philadelphia, San Francisco, 10 cents; Atlanta, Birmingham, Dallas, Houston, Los Angeles, Seattle, no charge.

	SHEETS				STRIP	BARS			STRUCTURAL	PLATES	
	Hot Rolled	Cold Rolled	Galv.	Stainless Type 302	Hot Rolled	H.R. Rounds	C.F. Rounds	H.R. Alloy 4140	SHAPES	Carbon	Floor
Atlanta	9.37	10.61	11.83	....	10.85	9.53	13.24	....	9.94	9.73	11.16
Baltimore	7.77	8.66	10.06	....	8.28	8.55	11.70	16.38	9.03	8.34	10.02
Birmingham	9.43	10.20	10.46	....	10.41	8.26	13.14	16.76	8.47	8.41	10.05
Boston	9.67	10.58	11.77	53.50	12.16	9.77	13.35	16.59	10.16	9.62	11.08
Buffalo	8.65	9.80	11.25	55.98	11.00	8.75	11.45	16.30	9.15	8.65	11.10
Charlotte, N. C.	9.87	11.22	10.30	....	10.86	9.67	12.68	....	9.88	9.82	11.46
Chicago	8.57	10.20	10.15	52.00	10.74	8.55	10.65	15.95	8.91	8.41	10.68
Cincinnati	8.74	10.26	10.20	65.30	11.06	8.87	11.53	16.27	9.47	8.79	11.01
Cleveland	8.57	9.88	11.24	56.18	10.86	8.66	11.25	16.06	9.30	8.65	10.92
Dallas	9.62	10.05	12.59	....	11.18	9.03	12.98	16.95	9.26	9.35	11.00
Detroit	8.83	10.46	10.50	52.00	11.11	8.86	11.01	16.23	9.47	8.78	10.94
Denver	9.41	11.77	12.11	....	9.86	10.10	11.47	....	10.02	9.69	11.83
Houston	9.22	9.65	12.19	52.00	10.78	8.63	13.10	16.55	8.86	8.95	10.60
Indianapolis	9.01	10.64	10.59	....	11.18	8.99	11.09	16.39	9.35	8.85	11.12
Kansas City	9.21	10.87	11.35	....	10.87	9.31	11.57	15.72	9.80	9.10	....
Los Angeles	8.95	11.20	11.45	61.27	10.65	9.00	14.20	17.35	9.90	8.40	11.15
Memphis, Tenn.	8.98	10.05	....	....	10.64	8.82	12.74	....	9.01	8.66	11.41
Milwaukee	8.71	10.34	10.29	....	10.88	8.69	10.89	16.09	9.13	8.55	10.82
Moline, Ill.	8.92	10.55	10.50	....	10.90	8.90	11.00	16.30	9.26	8.76	10.96
Newark, N. J.	9.36	10.13	11.35	....	11.46	9.74	13.25	16.40	10.20	9.51	11.05
New York	9.36	10.13	11.35	52.98	11.46	9.74	13.25	16.40	10.20	9.51	11.05
Philadelphia	8.35	9.60	10.66	52.71	10.35	8.75	11.95	16.38	8.95	8.70	9.95
Pittsburgh	8.57	9.88	11.13	52.00	10.84	8.55	11.25	15.95	8.91	8.41	10.68
Portland, Oreg.	9.45	11.30	12.35	....	11.45	9.45	16.65	17.80	10.05	9.60	11.75
St. Louis	8.77	10.58	10.53	....	10.94	8.77	11.28	16.33	9.14	8.62	10.91
St. Paul	8.84	9.59	10.84	....	11.01	8.82	11.49	16.54	9.18	8.68	10.44
San Francisco	10.17	11.69	11.40	54.00	11.78	10.07	15.10	17.25	10.49	10.38	12.47
Seattle	10.51	11.57	12.50	54.02	11.95	9.94	16.20	17.80	10.65	10.10	12.73
Spokane, Wash.	10.36	11.42	12.35	54.02	11.80	9.79	16.20	17.80	10.50	9.95	12.58

Specifications: Hot rolled sheet, sheared edge, 10 Ga. & 36 x 96-120 in.; cold rolled sheets, 20 Ga. & 36 x 96-120 in.; galvanized sheets, 10 Ga. x 36 x 120 in. except Los Angeles, Dallas and Houston, 10 Ga. x 48 x 120 in.; stainless, 16 Ga. & 36 in.; hot rolled strip, ⅛ in. x 1 in.; hot rolled carbon bars, rounds, ¾ in.—1¼ in., M1020; cold finished bars, 1 in., C1018; hot rolled alloy bars, 4140 annealed, 1⅝ in.—2⅞ in. rounds; structural shapes, I beams, 6 x 12½ in.; carbon plates, sheared, through ½ in. x 84 in.; floor plates, ¼ in. x 36 in.

Refractories

Fire Clay Brick (per 1000 pieces*)

High-Heat Duty: Ashland, Grahn, Hayward, Hitchins, Haldeman, Olive Hill, Ky., Athens, Troup, Tex., Beech Creek, Clearfield, Curwensville, Look Haven, Lumber, Orviston, West Decatur, Winburne, Snow Shoe, Pa., Bessemer, Ala., Farber, Mexico, St. Louis, Vandalia, Mo., Ironton, Oak Hill, Parrall, Portsmouth, Ohio, Ottawa, Ill., Stevens Pottery, Ga., Canon City, Colo., $140; Salina, Pa., $145; Niles, Ohio, $146; Cutler, Utah, $175.

Super-Duty: Ironton, Ohio, Vandalia, Mo., Olive Hill, Ky., Clearfield, Salina, Winburne, Snow Shoe, Pa., New Savage, Md., St. Louis, $185; Stevens Pottery, Ga., $195; Cutler, Utah, $248.

Silica Brick (per 1000 pieces*)

Standard: Alexandria, Claysburg, Mt. Union, Sproul, Pa., Ensley, Ala., Pt. Matilda, Pa., Portsmouth, Ohio, Hawstone, Pa., St. Louis, $158; Warren, Niles, Windham, Ohio, Hays, Latrobe, Morrisville, Pa., $163; E. Chicago, Ind., Joliet, Rockdale, Ill., $168; Canon City, Colo., $173; Lehi, Utah, $183; Los Angeles, $185.

Super-Duty: Sproul, Hawstone, Pa., Niles, Warren, Windham, Ohio, Leslie, Md., Athens, Tex., $158; Morrisville, Hays, Latrobe, Pa., $163; E. Chicago, Ind., St. Louis, $168; Canon City, Colo., $183; Curtner, Calif., $185.

Semisilica Brick (per 1000 pieces*)

Woodbridge, N. J., Canon City, Colo., $140; Philadelphia, Clearfield, Pa., $145.

Ladle Brick (per 1000 pieces*)

Dry-Pressed: Alsey, Ill., Chester, New Cumberland, W. Va., Freeport, Johnstown, Merrill Station, Pa., Vandalia, Mo., New Salisbury, Ohio, $97; Vanport, Pa., Wellsville, Irondale, Ohio, $100; Clearfield, Pa., Portsmouth, Ohio, $102; St. Louis, Mexico, Mo., $130.

High-Alumina Brick (per 1000 pieces*)

50 *Per Cent:* St. Louis, Mexico, Vandalia, Mo., Danville, Ill., $250; Philadelphia, $265; Clearfield, Pa., $230; Orviston, Snow Shoe, Pa., $260.

60 *Per Cent:* St. Louis, Mexico, Vandalia, Mo., $310; Danville, Ill., $312; Clearfield, Orviston, Snow Shoe, Pa., $320; Philadelphia, $325.

70 *Per Cent:* St. Louis, Mexico, Vandalia, Mo., $350; Danville, Ill., $353; Clearfield, Orviston, Snow Shoe, Pa., $360; Philadelphia, $365.

Sleeves (per 1000)

St. Louis, $193; Reesdale, Johnstown, Bridgeburg, St. Charles, Pa., $188; Ottawa, Ill., $205.

Nozzles (per 1000)

Reesdale, Johnstown, Bridgeburg, St. Charles, Pa., St. Louis, $310.

Runners (per 1000)

Reesdale, Johnstown, Bridgeburg, St. Charles, Clearfield, Pa., $234.

Dolomite (per net ton)

Domestic, dead-burned bulk, Billmeyer, Blue Bell, Williams, Plymouth Meeting, York, Pa., Millville, W. Va., Bettsville, Millersville, Martin, Woodville, Gibsonburg, Nario, Ohio, $16.75; Thornton, McCook, Ill., $17; Dolly Siding, Bonne Terre, Mo., $15.00.

Magnesite (per net ton)

Domestic, dead-burned, ⅛ in. grains with fines: Chewelah, Wash., Luning, Nev., $46; ⅜ in. grains with fines: Baltimore (periclase), $73; Pascagoula, Miss. (periclase), $90.

*—9 in. x 4½ x 2.50 straights.

Ores

Lake Superior Iron Ore

(Prices effective for the 1960 shipping season, subject to later revision, gross ton, 51.50% iron natural, rail of vessel, lower lake ports.)

Mesabi bessemer	$11.60
Lump ⅛ in. and up	12.85
Fines, under ⅛ in.	10.72
Mesabi nonbessemer	11.45
Old Range bessemer	11.85
Old Range nonbessemer	11.70
Open-hearth lump	12.70
High phos.	11.45

Based on upper lake rail freight rates, lake vessel freight rates, handling and unloading charges, and taxes thereon, which were in effect Jan. 1, 1960; increases or decreases after that date are absorbed by the seller.

Eastern Local Iron Ore

New Jersey, concentrates ..... nom.

Foreign Iron Ore

Cents per unit

Swedish basic, 65%, c.i.f. Atlantic ports 23.00†
Chilean, 62-65%, c.i.f. Atlantic ports .. 22.00
Brazilian, 68.5% f.o.b. vessel, Victoria, per ton $11.50

Tungsten Ore

Net ton, unit

Foreign wolframite, good commercial quality $19.75-20.00*
Domestic, concentrates, f.o.b. milling points 22.00-23.00

Manganese Ore

Mn 46-58%, Indian, 85-90c, nom. per long ton unit, c.i.f. U. S. ports, duty for buyer's account.

Chrome Ore

Gross ton, f.o.b. cars New York, Philadelphia, Baltimore, Charlestown, S. C., plus ocean freight differential for delivery to Portland, Oreg., Tacoma, Wash.

Indian and Rhodesian

48% 3:1 ..... $34.00-35.00†
48% no ratio ..... 25.00-26.00†

South African Transvaal

44% no ratio ..... 18.75†
48% no ratio ..... 24.00-26.00†

Turkish

48% 3:1 ..... 36.00-37.00†

Domestic

Rail nearest seller

18% 3:1 ..... 30.00

Molybdenum

Sulfide concentrate, per lb of Mo content, mines, unpacked $1.23

Antimony Ore

Per short ton unit of Sb content, c.i.f. seaboard

55-60% $2.50-2.80
60-65% 2.80-3.20

Vanadium Ore

Cents per lb V_2O_5

Domestic 31.00

*Before duty. †Nominal.

Canadian Steel

(Cents per lb, f.o.b. mill, except as otherwise noted.)

Billets, Blooms & Slabs:	
Carbon (N.T.):	
Forging	$97.00
Rerolling	78.00
Alloy (N.T.)	115.00
Wire Rods:	
Carbon	5.70
Alloy	6.40
Wire (carload lots):	
Merchant annealed	8.40
Low carbon indus.	7.20
Upholstery spring	8.55
M.B. spring	8.85
Bars & Small Shapes:	
Carbon, merchant	5.30
Carbon, special	5.85
Alloy	6.40
Bar Mill Bands:	
Carbon	5.40
Alloy	8.05
Bars, Reinforcing	5.30
Structural Shapes:	
Standard carbon	5.50
Angles & zees	5.40
Plates, Carbon:	
Sheared	5.45
Universal mill	5.10
Sheets & Coils, Hot Rolled:	
Carbon sheet	4.95
Carbon strip	5.00
Sheets & Coils, Cold Rolled:	
Carbon sheet	6.35
Carbon strip:	
(0.080 and lighter)	6.35
(0.081 and heavier)	6.65
Sheets & Coils, Galvanized:	
Standard quality	6.70
Culvert quality	7.00
Sheets, Porcelain Enameling	7.45
Sheets & Coils, Electrical:	
Field grade	9.00
Armature grade	9.50
Electrical grade	10.15
Sheet Piling	6.15
Skelp	4.70
Rails, Heavy	5.55
Rails, Light	5.70
Joint Bars	6.55
Tie Plates	6.35
Grinding Balls (3 in. diam.)	7.00
Tin Mill	(Per base box;
Products	100 lb base wt)
Coke tin plate (1.25 lb pot yield)	$10.60
Electrolytic tin plate (0.25 lb coating).	9.10
Black plate	8.30
Nails, Wholesale:	
Carload lots	Col. 110

Fluorspar

Metallurgical grades, f.o.b. shipping point in Ill., Ky., net tons, carloads, effective CaF_2 content 72.5%, $37-$41; 70%, $36-$40; 60%, $33-$36.50. Imported, net ton, f.o.b. cars point of entry, duty paid, metallurgical grade; European, $30-$33, contract; Mexican, all rail, duty paid, $28-$28.50; barge, Brownsville, Tex., $30-$31.

Metal Powder

(Per pound, f.o.b. shipping point in ton lots for minus 100 mesh, except as noted.)

	Cents
Sponge Iron, domestic and foreign, 98% Fe, min. trucklots, freight allowed east of Mississippi River:	
100 mesh, bags	11.50
100 mesh, pails	9.85‡
40 mesh, bags	8.10††
Electrolytic Iron, Melting stock, 99.9% Fe, irreg. fragments, ⅛ in. x 1.3 in.	28.75

(In contract lots of 750 tons price is 22.75c.)

Annealed, 99.5% Fe, ton, del. east of Mississippi.	36.75
Unannealed (99+% Fe)	33.0
Unannealed (99+% Fe) (minus 325 mesh)	58.0
Carbonyl Iron: 90-99.9%, 3 to 20 microns, depending on grade, 88.00-700.00 in standard 200-lb containers; all minus 200 mesh.	
Aluminum: Atomized, 600-lb drum freight allowed, c.l.	39.80; ton lots 41.80
Brass, 80/20, leaded (60 mesh)	37.50
Bronze powder, 90/10.	55.10
Copper, all types	15.25*
Lead	7.50*
Manganese, minus 35 mesh	1.00
Nickel, all types	0.78-1.06
Nickel-Silver	58.70
Solder	7.50*
Stainless Steel, 304	89.00
Stainless Steel, 316	$1.07
Steel, AISI 4650	32.00
Tin	14.00*
Zinc	24.20
Cobalt:	Dollars
98.5%, minus 100-300 mesh	1.57-1.58
99.5%, below 5 microns	2.32
Tungsten	nom.
Molybdenum	4.35

*Plus cost of metal. ‡Depending on mesh. §Cutting and scarfing grades. **Depending on price of ore. ††Welding grade.

Metallurgical Coke

Price per net ton

Beehive Ovens

Connellsville, Pa., furnace	$14.75-15.25
Connellsville, Pa., foundry	18.00-18.50

Oven Foundry

Birmingham, ovens	$30.35
Cincinnati, deld.	33.34
Buffalo, ovens	32.00
Chattanooga, Tenn., ovens	30.80
Detroit, ovens	32.00
Pontiac, Mich., deld.	34.05
Saginaw, Mich., deld.	35.63
Erie, Pa., ovens	32.00
Everett, Mass., ovens:	
New England, deld.	33.55*
Indianapolis, ovens	31.25
Ironton, Ohio, ovens	30.50
Cincinnati, deld.	33.64
Kearny, N. J., ovens	31.25
Milwaukee, ovens	32.00
Neville Island (Pittsburgh), Pa., ovens	30.75
Painesville, Ohio, ovens	32.00
Cleveland, deld.	34.45
Philadelphia, ovens	31.00
St. Louis, ovens	33.00
St. Paul, ovens	31.25
Chicago, deld.	34.78
Swedeland, Pa., ovens	31.00
Terre Haute, Ind., ovens	31.25

*Within $5.25 freight zone from works.

Imported Steel

(Base per 100 lb, landed, duty paid; based on current ocean rates with any rise for buyer's acc't. Source of shipment: Western Europe)

	North Atlantic	Great Lakes*	South Atlantic	Gulf Coast	West Coast
Deformed Bars, Intermediate, ASTM-A 305	$5.62	....	$5.52	$5.37	$5.72
Bar Size Angles	5.75	....	5.65	5.50	5.85
Structural Angles	5.65	....	5.55	5.40	5.75
I-Beams	5.65	....	5.55	5.40	5.75
Channels	5.65	....	5.55	5.40	5.75
Plates (basic bessemer)	5.70	....	5.60	5.45	5.80
Sheets, hot rolled and galvanized	Nom.	....	Nom.	Nom.	Nom.
Furring Channels, C.R., 1000 ft, ⅞ x 0.30 lb per ft	25.20	....	24.40	24.40	25.20
Barbed Wire (†)	6.50	....	6.40	6.25	6.60
Merchant Bars	5.75	....	5.65	5.50	5.85
Hot-Rolled Bands	5.85	....	5.75	5.60	5.90
Wire Rods, Thomas Commercial No. 5	5.80	....	5.75	5.75	6.00
Wire Rods, O. H., No. 5	6.00	....	5.95	5.95	6.25
Bright Common Wire Nails (‡)	6.85	....	6.75	6.60	6.95

*Book closed for 1960-61 shipping season. †Per 82 lb net reel. ‡Per 100-lb keg, 20d nails and heavier.

Coal Chemicals

(Representative prices)

Cents per gal f.o.b. tank cars or tank trucks, plant.

Pure benzene	34.00
Xylene, industrial grade	29.00
Creosote	24.00
Naphthalene, 78 deg.	6.00
Toluene, one deg. (deld. east of Rockies)	25.00

Cents per lb, f.o.b. tank cars or tank trucks, deld.

Phenol, 90 per cent grade	14.75

Per net ton bulk, f.o.b. cars or trucks, plant.

Ammonium sulfate, regular grade	$32.00

Ferroalloys

MANGANESE ALLOYS

Spiegeleisen: Carlot, 10 lb pigs, per gross ton, Palmerton, Pa. 21-23% Mn, $102.50; 19-21% Mn, 1-3% Si, $100; 16-19% Mn $98. For Neville Island, Pa., prices add $2.50 as of Feb. 1. Lump 35 lb and down: Deduct $2 from 10 lb pig prices at Palmerton.

Standard Ferromanganese: (Mn 74-76%, C 7% approx) base price per net ton, $220, Johnstown, Duquesne, Sheridan, Neville Island, Pa.; Alloy, W. Va.; Ashtabula, Marietta, O.; Rockwood, Tenn.; Houston, Tex.; Sheffield, Ala.; Portland, Oreg. Add or subtract $2 for each 1% or fraction thereof of contained manganese over 76% or under 74%, respectively (Min 79-81%). Lump $228 per net ton, f.o.b. Anaconda, Mont. Add $2.60 for each 1% above 81%; subtract $2.60 for each 1% below 79%, fractions in proportion to nearest 0.1%.

High-Grade Low-Carbon Ferromanganese: (Mn 85-95%). Carload, lump, bulk, max 0.07% C, 35.1c per lb of contained Mn, carload packed 36.4c, ton lots 37.9c, less ton 39.1c. Delivered. Deduct 4c for max 0.15% C grade from above prices, 5.3c for max 0.03% C, 6.6c for max 0.5% C, and 8.1c for max 75% C—max 7% Si. **Special Grade:** (Mn 90% min, C 0.07% max, P 0.06% max). Add 2.05c to the above prices. Spot, add 0.25c.

Medium-Carbon Ferromanganese: (Mn 80-85%, C 1.25-1.5%, Si 1.5% max). Carload, lump, bulk, 24c per lb of contained Mn; packed, carload 25.3c, ton lot 26.9c, less ton 28.1c.

Electrolytic Manganese Metal: Min carload, bulk, 34.25c; 2000 lb to min carload, 37c; less ton, 39c; 50 lb cans, add 0.5c per lb. Premium for hydrogen-removed metal 0.75c per lb. Prices are f.o.b. cars, Knoxville, Tenn., freight allowed to St. Louis or any point east of Mississippi River; or f.o.b. Marietta, O., freight allowed.

Silicomanganese: (Mn 65-68%). Carload, lump, bulk, 1.50% C grade, 18.5-21% Si, 11.6c per lb of alloy. Packed, c.l. 12.8c, ton 13.25c, less ton 14.25c, f.o.b. Alloy, W. Va.; Ashtabula, Marietta, O.; Rockwood, Tenn.; Houston, Tex.; Sheffield, Ala.; Portland, Oreg. For 2% C grade, Si 16-18.5%, deduct 0.3c from above prices. For 3% grade, Si 12.5-16% deduct 0.5c from above prices. Spot, add 0.25c.

TITANIUM ALLOYS

Ferrotitanium, Low-Carbon: (Ti 20-25%, Al 3.5% max, Si 4% max, C 0.10% max). Contract, ton lot, 2" x D, $1.50 per lb of contained Ti; less ton to 300 lb, $1.55. (Ti 38-43%, Al 8% max, Si 4% max, C 0.10% max). Ton lot $1.35, less ton to 300 lb $1.37, f.o.b. Niagara Falls, N. Y., freight allowed to St. Louis.

Ferrotitanium, High-Carbon: (Ti 15-18%, C 6-8%). Contract min c.l. $250 per ton, f.o.b. Niagara Falls, N. Y., freight allowed to destinations east of Mississippi River and north of Baltimore and St. Louis. Spot, $255.

Ferrotitanium, Medium-Carbon: (Ti 17-21%, C 2-4%). Contract, c.l. $300 per ton, f.o.b. Niagara Falls, N. Y., freight not exceeding St. Louis rate allowed. Spot, $305.

CHROMIUM ALLOYS

High-Carbon Ferrochrome: C.l. lump, bulk, 28.75c per lb of contained Cr. Delivered.

Charge Chrome: Cr 50-56%, C 6-8%, Si 4-7%, 22.00c; Cr 58-63%, C 5.8%, Si 3-6%, 22.50c per lb of contained Cr, carlots, lump, bulk, delivered.

Blocking Chrome: Cr 55-63%, C 4-6%, Si 8-12%, 23.50c per lb of contained Cr, delivered in carlots, lump, bulk.

Refined Chrome: Cr 53-63%, C 3-5%, Si 2.5% max, 26.00c per lb of contained Cr, delivered in carlots, lump, bulk.

Low-Carbon Ferrochrome: Cr 63-66% (Simplex), carload, lump, bulk, C 0.025% max, 33.50c per lb contained Cr; 0.010% max, 34.50c. Delivered.

Cr, 65-71%, carload, lump, bulk, 0.025% max, 35.00c; 0.05% max, 34.00c; 0.10% max, 33.75c; 0.20% max, 33.50c; 0.50% max, 33.25c; 1.0% max, 33.00c; 1.5% max, 32.75c; 2.0% max, 32.50c. Delivered.

Foundry Ferrochrome, High-Carbon: (Cr 62-66%, C 5-7%, Si 7-10%). C.l., 2" x D, bulk 30.8c per lb of contained Cr. Packed, c.l. 32.4c, ton 34.2c, less ton 35.7c. Delivered. Spot, add 0.25c.

Foundry Ferrosilicon Chrome: (Cr 50-54%, Si 28-32%, C 1.25% max). 8M x D, carload, bulk, 20.05c per lb of alloy carload packed 21.25c, ton lot 22.50c, less ton lot 23.70c. Delivered. Spot, add 0.25c.

Ferrochrome-Silicon: Cr 39-41%, Si 42-45%, C 0.05% max, 24.50c per lb contained Cr and 14.60c per lb contained Si; Cr 33-36%, Si 45-48%, C 0.05% max, 24.50c per lb contained Cr, 14.60c per lb contained Si; 0.75 in. x down, 26.25c per lb contained Cr, 14.60c per lb contained Si.

Chromium Metal, Electrolytic: Commercial grade (C 99.8% min, metallic basis Fe 0.2% max). Contract, carlot packed, 2" x D plate (above ⅛" thick) $1.15 per lb, ton lot $1.17, less ton lot $1.19. Delivered. Spot, add 5c.

VANADIUM ALLOYS

Ferrovanadium: Open hearth grade (V 50-55%, Si 8% max, C 3% max). Contract, any quantity, $3.20 per lb of contained V. Delivered. Spot, add 10c. **Special Grade:** (V 50-55% or 70-75%, Si 2% max, C 0.5% max) $3.30. **High Speed Grade:** (V 50-55% or 70-75%, Si 1.50% max, C 0.20% max) $3.40.

Grainal: Vanadium Grainal No. 1, $1.05 per lb; No. 79, 50c, freight allowed.

Vanadium Oxide: Contract, less carload lot, packed, $1.38 per lb contained V_2O_5 freight allowed. Spot, add 5c.

SILICON ALLOYS

50% Ferrosilicon: Carload, lump, bulk, 14.6c per lb contained Si. Packed, c.l. 17.1c, ton lot 18.55c, less ton 20.20c, f.o.b. Alloy, W. Va.; Ashtabula, Marietta, O.; Chattanooga, Rockwood, Tenn.; Houston, Tex.; Sheffield, Ala.; Keokuk, Iowa; Portland, Oreg. Spot, add 0.45c.

Low-Aluminum 50% Ferrosilicon: (Al 0.40% max). Add 1.45c to 50% ferrosilicon prices.

65% Ferrosilicon: Carload, lump, bulk, 15.75c per lb contained silicon. Packed, c.l. 17.75c, ton lot 19.55c, less ton 20.9c. Delivered. Spot, add 0.35c.

75% Ferrosilicon: Carload, lump, bulk, 16.9c per lb of contained Si. Packed, c.l. 18.8c, ton lot 20.45c, less ton 21.7c. Delivered. Spot, add 0.3c.

90% Ferrosilicon: Carload, lump, bulk, 20c per lb of contained Si. Packed, c.l. 21.65c, ton lot 23.05c, less ton 24.1c. Delivered. Spot, add 0.25c.

Silicon Metal: (98% min Si, 1.00% max Fe, 0.7% max Ca). C.l. lump, bulk, 21.5c per lb of Si. Packed, c.l. 23.15c, ton lot 24.45c, less ton 25.45c. Add 0.5c for max 0.03% Ca grade. Add 0.5c for 0.50% Fe grade analyzing 98.25% min Si.

Alsifer: (Approx 20% Al, 40% Si, 40% Fe). Contract, basis f.o.b. Niagara Falls, N. Y., lump, carload, bulk, 9.85c per lb of alloy; ton lots, packed, 10.85c.

ZIRCONIUM ALLOYS

12-15% Zirconium Alloy: (Zr 12-15%, Si 39-43%, C 0.20% max). Contract, c.l., lump, bulk, 9.25c per lb of alloy. Packed, c.l. 10.45c, ton lot 11.6c, less ton 12.45c. Delivered. Spot, add 0.25c.

35-40% Zirconium Alloy: (Zr 35-40%, Si 47-52%, Fe 8-12%, C 0.50% max). Carload, bulk, 26.25c per lb of alloy, carload, lump, packed 27.25c, ton lot 28.4c, less ton 29.65c. Freight allowed. Spot, add 0.25c.

BORON ALLOYS

Ferroboron: 100 lb or more packed (B 17.50% min, Si 1.50% max, Al 0.50% max, C 0.50% max). Contract, 100 lb or more 1" x D, $1.20 per lb of alloy; less than 100 lb $1.30. Delivered. Spot, add 5c. F.o.b. Washington, Pa., prices 100 lb and over are as follows: Grade A (10-14% B) 85c per lb; Grade B (14-18% B) $1.20; Grade C (19% min B) $1.50.

Borosil: (3 to 4% B, 40 to 45% Si). Carload, bulk, lump, or 3" x D, $5.25 per lb of contained B. Packed, carload, $5.40, ton to c.l. $5.50, less ton $5.60. Delivered.

Carbortam: (B 1 to 2%). Lump, carload $320 per ton, f.o.b. Suspension Bridge, N. Y., freight allowed same as high-carbon ferrotitanium.

CALCIUM ALLOYS

Calcium-Manganese-Silicon: (Ca 16-20%, Mn 14-18% and Si 53-59%). Carload, lump, bulk 23c per lb of alloy, carload packed 24.25c, ton lot 26.15c, less ton 27.15c. Delivered. Spot, add 0.25c.

Calcium-Silicon: (Ca 30-33%, Si 60-65%, Fe 1.5-3%). Carload, lump, bulk 24c per lb of alloy, carload packed 25.65c, ton lot 27.95c, less ton 29.45c. Delivered. Spot, add 0.25c.

BRIQUETED ALLOYS

Chromium Briquets: (Weighing approx 3¾ lb each and containing 2 lb of Cr). Carload, bulk 19.60c per lb of briquet, in bags 20.70c; 3000 lb to c.l. pallets 20.80c; 2000 lb to c.l. in bags 21.90c; less than 2000 lb in bags 22.80c. Delivered. Spot, add 0.25c.

Ferromanganese Briquets: (Weighing approx 3 lb and containing 2 lb of Mn). Carload, bulk 13.7c per lb of briquet; c.l. packed, bags 14.9c; 3000 lb to c.l., pallets 14.9c; 2000 lb to c.l., bags 16.1c; less ton 17c. Delivered. Spot, add 0.25c.

Silicomanganese Briquets: (Weighing approx 3½ lb and containing 2 lb of Mn and approx ½ lb of Si). C.l. bulk 14c per lb briquet; c.l. packed, bags 15.2c; 3000 lb to c.l., pallets 15.2c; 2000 lb to c.l., bags 16.4c; less ton 17.3c. Delivered. Spot, add 0.25c.

Silicon Briquets: (Large size—weighing approx 5 lb and containing 2 lb of Si and small sizes, weighing approx 2½ lb and containing 1 lb of Si). Carload bulk 8c per lb of briquet; packed, bags 9.2c; 3000 lb to c.l., pallets 9.6c; 2000 lb to c.l., bags 10.8c; less ton 11.7c. Delivered. Spot, add 0.25c.

Molybdic-Oxide Briquets: (Containing 2½ lb of Mo each). $1.49 per lb of Mo contained, f.o.b. Langeloth, Pa.

Titanium Briquets: Ti 98.27%, $1 per lb f.o.b. Niagara Falls, N. Y.

TUNGSTEN ALLOYS

Ferrotungsten: (70-80%). 5000 lb W or more $2.15 per lb. (nominal) of contained W. Delivered.

OTHER FERROALLOYS

Ferrocolumbium: (Cb 50-60%, Si 4% max, C 0.1% max). Ton lots 2" x D, $3.45 per lb of contained Cb; less ton lots $3.50 (nominal). Delivered.

Ferrotantalum Columbium: (Cb 44-77% approx, Ta 15% approx, and Cb plus Ta 60% min, C 0.30% max). Ton lots 2" x D, $3.05 per lb of contained Cb plus Ta, delivered; less ton lots, $3.10.

SMZ Alloy: (Si 60-65%, Mn 5-7%, Zr 5-7%, Fe 20% approx). Carload, bulk 19.25c per lb of alloy, c.l. packed ½ in. x 12 M 20.00c, ton lot 21.15c, less ton 22.40c. Delivered. Spot, add 0.25c.

Graphidox No. 4: (Si 48-52%, Ca 5-7%, Ti 9-11%). C.l. packed, 20% per lb of alloy, ton lot 21.15c; less ton lot 22.4c, f.o.b. Niagara Falls, N. Y., freight allowed to St. Louis.

V-3 Foundry Alloy: (Cr 38-42%, Si 17-19%, Mn 8-11%). C.l. packed 18.45c per lb of alloy; ton lot 19.95c; less ton lot 21.20c, f.o.b. Niagara Falls, N. Y., freight allowed to St. Louis.

Siminal: (Approx 20% each Si, Mn, Al; bal Fe). Lump, carload, bulk, 19.25c. Packed c.l. 20.25c; 2000 lb to c.l. 21.25c; less than 2000 lb 21.75c per lb of alloy. Delivered.

Ferrophosphorus: (23-25% based on 24% P content with unitage of $5 for each 1% of P above or below the base). Carload, bulk, f.o.b. sellers' works, Mt. Pleasant, Siglo, Tenn., $120 per gross ton.

Ferromolybdenum: (65-75%). Per lb of contained Mo in 200-lb container, f.o.b. Langeloth and Washington, Pa., $1.76 in all sizes except powdered which is $1.82.

Technical Molybdic-Oxide: Per lb of contained Mo, in cans $1.47; in bags, $1.46, f.o.b. Langeloth and Washington, Pa.

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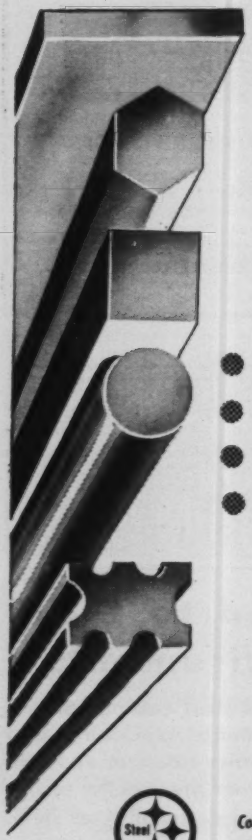

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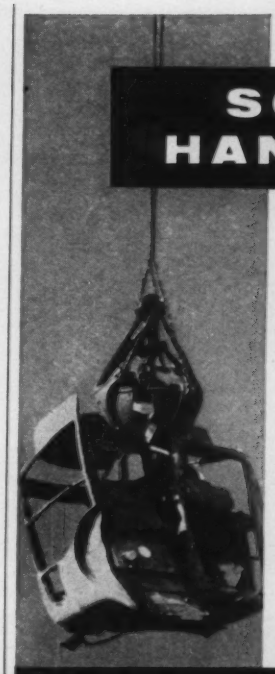

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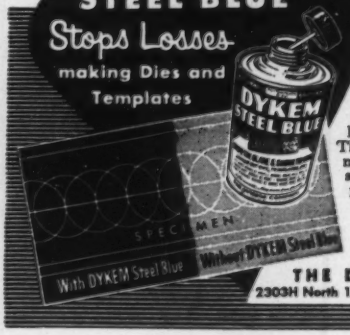

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Scrap Is Gathering New Strength

STEEL's composite on No. 1 heavy melting grade rises 33 cents for second straight week. It now stands at $29.33. Buying still lags, but sellers anticipate early January pickup

Scrap Prices, Page 302

● **Pittsburgh**—The local plant of GM's Fisher Body Div. sold 1200 tons of surplus No. 1 bundles from its December list at $32.50 per ton, up $3. The sale confirms a market uptrend that started when the railroads got higher prices for material on their December lists. Although the mills aren't buying, sellers hope that a steelmaking upturn will force some January scrap purchases.

● **Chicago**—Yearend activity in the scrap market is holding prices unchanged. Scrapmen remain optimistic despite the easing in steel production during the holiday period. First test of market strength will be revealed in the yearend bids on auto plant lists.

● **Philadelphia**—Domestic prices on No. 1 heavy melting steel are up $1 to $35, delivered, the first increase in that grade in about two months. Prices also have advanced $1 on several other grades, with No. 2 heavy melting holding at $31, No. 1 bundles at $36, No. 1 bushelling at $36, and electric furnace bundles at $37. The market on heavy breakable cast has advanced $2 to $39, delivered. Advances reflect strong export demand and adverse weather conditions, and were made on small sales.

● **New York**—Despite an active export market and adverse winter weather, brokers' buying prices on the major grades are unchanged. Most brokers believe an early upturn in prices is likely.

● **Cleveland** — With the holidays past, scrapmen are anticipating a gradual pickup in buying by the steel mills and foundries. The contraction in blast furnace operations in recent weeks and resulting drop in hot metal availability is thought likely to increase steelmakers' dependence on scrap for furnace melts. At current prices, scrap provides an attractive and economical furnace charge. In line with the firmer market, dealers anticipate higher prices, largely basing their hopes on slightly higher bids on auto list scrap at the monthend.

● **Youngstown** — Activity in the market here is centered in the filling out of old orders. Some pickup in buying is expected now that the holidays are past, especially with some steel plants reportedly charging unusually high ratios of scrap (60 to 65 per cent) in their furnaces.

● **St. Louis**—Demand for scrap is picking up a little, especially in specialty lines. Steelmakers are taking all the tonnage they can get at current price levels, and dealers are more confident a turn is underway. To some extent, the firmer market results from developments outside this immediate area, largely being spurred by export orders at seaboard points. Not much scrap is available here at current prices. Random length rails have moved up $1 to $36. Rails (18 in. and under) are also up $1 to $39, while angles and splice bars are quoted $3 higher at $35.

● **Buffalo**—The market is holding pricewise despite the absence of buying. Dealers are hoping for placement of new mill business early this quarter. Supplies of scrap coming to local yards have been light recently. That's the result of the low prices prevailing, cold weather, and reduced activity at metalworking plants which generate scrap.

● **Houston**—Prices are unchanged in this area. Domestic demand is sluggish, but a fairly active movement is reported on export account. Mexican buyers are out of the market, and Texas mills are doing little buying. Lone Star Steel has increased its activity a little—scrapmen are hoping it will result in a pickup in their market.

● **Seattle**—Current prices are expected to hold over the next several weeks. Business was disappointing in December, but the outlook for January is improved and higher prices may develop before the end of the month. Large consumers may return to the market to replenish inventories, while export requirements may increase during the month.

● **San Francisco**—Even though the market is lifeless, dealers have been finding it necessary to pay more than they expected for the material they are accumulating for shipment to Japan. In some instances, they have upped quotations to stimulate collections.

Structural Orders Turn Upward During November

Structural steel bookings in November turned upward for the first time since July, reports the American Institute of Steel Construction.

(*Please turn to Page* 307)

Iron and Steel Scrap

STEELMAKING SCRAP COMPOSITE

Dec. 28	$29.33
Dec. 14	29.00
Nov. Avg.	28.83
Dec. 1959	41.71
Dec. 1955	50.37

Based on No. 1 heavy melting grade at Pittsburgh, Chicago, and eastern Pennsylvania.

Consumer prices per gross ton, except as otherwise noted, including brokers' commission, as reported to STEEL, Dec. 28, 1960. *Changes shown in italics.*

PITTSBURGH

No. 1 heavy melting	26.00-27.00
No. 2 heavy melting	21.00-22.00
No. 1 dealer bundles	27.00-28.00
No. 2 bundles	20.00-21.00
No. 1 busheling	26.00-27.00
No. 1 factory bundles	*34.00-35.00*
Machine shop turnings	11.00-12.00
Mixed borings, turnings	11.00-12.00
Short turnings	15.00-16.00
Cast iron borings	15.00-16.00
Cut structurals:	
2 ft and under	31.00-32.00
3 ft and under	30.00-31.00
Heavy turnings	27.00-28.00
Punchings & plate scrap	34.00-35.00
Electric furnace bundles	*35.00-36.00*

Cast Iron Grades (F.o.b. shipping point)

No. 1 cupola	31.00-32.00
Stove plate	27.00-28.00
Unstripped motor blocks	22.00-23.00
Clean auto cast	31.00-32.00
Drop broken machinery	44.00-45.00‡

Railroad Scrap

No. 1 R.R. heavy melt.	29.00-30.00
Rails, 2 ft and under	48.00-49.00
Rails, 18 in. and under	49.00-50.00
Random rails	41.00-42.00
Angles, splice bars	37.00-38.00
Railroad specialties	39.00-40.00
Rails, rerolling	53.00-54.00

Stainless Steel Scrap

18-8 bundles & solids	175.00-180.00
18-8 turnings	95.00-100.00
430 bundles & solids	90.00-95.00
430 turnings	50.00-55.00

CHICAGO

No. 1 hvy melt., indus.	27.00-28.00
No. 1 hvy melt., dealer	25.00-26.00
No. 2 hvy melting	23.00-24.00
No. 1 factory bundles	30.00-31.00
No. 1 dealer bundles	26.00-27.00
No. 2 bundles	16.00-17.00
No. 1 busheling, indus.	27.00-28.00
No. 1 busheling, dealer	25.00-26.00
Machine shop turnings	11.00-12.00
Mixed borings, turnings	13.00-14.00
Shovel turnings	13.00-14.00
Cast iron borings	13.00-14.00
Cut structurals, 3 ft	31.00-32.00
Punchings & plate scrap	33.00-34.00

Cast Iron Grades

No. 1 cupola	37.00-38.00
Stove plate	31.00-32.00
Unstripped motor blocks	29.00-30.00
Clean auto cast	42.00-43.00
Drop broken machinery	42.00-43.00

Railroad Scrap

No. 1 R.R. heavy melt.	29.00-30.00
R.R. malleable	41.00-42.00
Rails, 2 ft and under	43.00-44.00
Rails, 18 in. and under	44.00-45.00
Angles, splice bars	38.00-39.00
Axles	49.00-50.00
Rails, rerolling	48.00-49.00

Stainless Steel Scrap

18-8 bundles, solids	160.00-165.00
18-8 turnings	90.00-95.00
430 bundles & solids	75.00-80.00
430 turnings	40.00-45.00

DETROIT

(Brokers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	17.00-18.00
No. 2 heavy melting	13.00-14.00
No. 1 bundles	19.00-20.00
No. 2 bundles	10.00-11.00
No. 1 busheling	16.00-17.00
Machine shop turnings	5.00-6.00
Mixed borings, turnings	5.00-6.00
Shovel turnings	6.00-7.00

Cast Iron Grades

No. 1 cupola	28.00-29.00
Stove plate	22.00-23.00
Heavy breakable	21.00-22.00
Unstripped motor blocks	17.00-18.00
Charging box cast	23.00-24.00
Clean auto cast	34.00-35.00

CLEVELAND

No. 1 heavy melting	23.00-24.00
No. 2 heavy melting	19.00-20.00†
No. 1 factory bundles	*28.00-29.00*
No. 1 bundles	23.00-24.00
No. 2 bundles	16.00-17.00
No. 1 busheling	23.00-24.00
Machine shop turnings	10.00-11.00
Shovel turnings	14.00-15.00
Mixed borings, turnings	14.00-15.00
Cast iron borings	14.00-15.00
Cut foundry steel	28.00-29.00
Cut structurals, plate 2 ft and under	*33.50-34.50*
Low phos. punchings & plate	26.00-27.00
Alloy free, short shovel turnings	14.00-15.00
Electric furnace bundles	24.00-25.00

Cast Iron Grades

No. 1 cupola	37.00-38.00
Charging box cast	24.00-25.00
Heavy breakable cast	26.00-27.00
Stove plate	34.00-35.00
Unstripped motor blocks	28.00-29.00
Brake shoes	35.00-36.00
Clean auto cast	42.00-43.00
Burnt cast	30.00-31.00
Drop broken machinery	42.00-43.00

Railroad Scrap

R.R. malleable	42.00-43.00
Rails, 2 ft and under	45.00-46.00
Rails, 18 in. and under	45.00-46.00
Rails, random lengths	38.00-39.00
Cast steel	32.00-33.00
No. 1 railroad cast	42.00-43.00
Railroad specialties	37.00-38.00
Angles, splice bars	36.00-37.00
Rails, rerolling	51.00-52.00

Stainless Steel Scrap (Brokers' buying prices; f.o.b. shipping point)

18-8 bundles, solids	150.00-155.00
18-8 turnings	65.00-70.00
430 clips, bundles, solids	65.00-70.00
430 turnings	10.00-20.00

YOUNGSTOWN

No. 1 heavy melting	26.00-27.00
No. 2 heavy melting	21.00-22.00
No. 1 busheling	26.00-27.00
No. 1 bundles	26.00-27.00
No. 2 bundles	20.00-21.00
Machine shop turnings	12.00-13.00
Shovel turnings	17.00-18.00
Cast iron borings	17.00-18.00
Low phos.	27.00-28.00
Electric furnace bundles	27.00-28.00

Railroad Scrap

No. 1 R.R. heavy melt.	29.50-30.50

BUFFALO

No. 1 heavy melting	23.00-24.00
No. 2 heavy melting	19.00-20.00
No. 1 bundles	23.00-24.00
No. 2 bundles	16.00-17.00
No. 1 busheling	23.00-24.00
Shovel turnings	13.00-14.00
Machine shop turnings	9.00-10.00
Cast iron borings	11.00-12.00
Low phos. structurals and plates, 2 ft and under	33.00-34.00

Cast Iron Grades (F.o.b. shipping point)

No. 1 cupola	36.00-37.00
No. 1 machinery	43.00-44.00

Railroad Scrap

Rails, random lengths	36.00-37.00
Rails, 3 ft and under	42.00-43.00
Railroad specialties	35.00-36.00

CINCINNATI

(Brokers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	22.50-23.50
No. 2 heavy melting	19.50-20.50
No. 1 bundles	23.50-24.50
No. 2 bundles	15.00-16.00
No. 1 busheling	22.50-23.50
Machine shop turnings	8.00-9.00
Mixed borings, turnings	8.00-9.00
Shovel turnings	10.00-11.00
Cast iron borings	10.00-11.00
Low phos. 18 in.	31.00-32.00

Cast Iron Grades

No. 1 cupola	34.00-35.00
Heavy breakable cast	28.00-29.00
Charging box cast	34.00-35.00
Drop broken machinery	44.00-45.00

Railroad Scrap

No. 1 R.R. heavy melt.	28.00-29.00
Rails, 18 in. and under	44.00-45.00
Rails, random lengths	36.00-37.00

PHILADELPHIA

No. 1 heavy melting	*35.00*
No. 2 heavy melting	*31.00*
No. 1 bundles	*36.00*
No. 2 bundles	21.00
Electric furnace bundles	*37.00*
No. 1 busheling	*36.00*
Mixed borings, turnings	14.00†
Shovel turnings	18.00†
Machine shop turnings	13.00†
Heavy turnings	25.00†
Structurals & plates	37.00-39.00
Couplers, springs, wheels	37.00
Rail crops, 2 ft & under	46.00-48.00

Cast Iron Grades

No. 1 cupola	38.00
Heavy breakable cast	*39.00*
Drop broken machinery	47.00-48.00
Malleable	46.00†

NEW YORK

(Brokers' buying prices)

No. 1 heavy melting	27.00-28.00
No. 2 heavy melting	18.00-19.00
No. 1 bundles	27.00-28.00
No. 2 bundles	14.00-15.00
Machine shop turnings	3.50-4.00†
Mixed borings, turnings	4.00-4.50†
Shovel turnings	5.00-6.00†
Low phos. structurals & plates	31.00-32.00†

Cast Iron Grades

No. 1 cupola	34.00-35.00
Unstripped motor blocks	23.00-24.00
Heavy breakable	28.00-29.00

Stainless Steel

18-8 sheets, clips, solids	140.00-145.00†
18-8 borings, turnings	70.00-75.00†
410 sheets, clips, solids	40.00-45.00
430 sheets, clips, solids	50.00-55.00†

BOSTON

(Brokers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	23.00-24.00
No. 2 heavy melting	19.00-20.00
No. 1 bundles	23.00-24.00
No. 1 busheling	23.00-24.00
Machine shop turnings	5.00-6.00
Shovel turnings	9.00-9.50
No. 1 cast	39.00-40.00
Mixed cupola cast	30.00-30.50
No. 1 machinery cast	40.00-42.00

BIRMINGHAM

No. 1 heavy melting	28.00-29.00
No. 2 heavy melting	22.00-23.00
No. 1 bundles	28.00-29.00
No. 2 bundles	20.00-21.00
No. 1 busheling	29.00-30.00
Cast iron borings	10.00-11.00
Machine shop turnings	15.00-16.00
Shovel turnings	18.00-19.00
Bar crops and plate	35.00-36.00†
Structurals & plate	35.00-36.00†
Electric furnace bundles	30.00-31.00†
Electric furnace:	
3 ft and under	31.00-32.00
2 ft and under	33.00-34.00

Cast Iron Grades

No. 1 cupola	41.00-42.00†
Stove plate	41.00-42.00†
Unstripped motor blocks	30.00-31.00†
No. 1 wheels	34.00-35.00

Railroad Scrap

No. 1 R.R. heavy melt.	32.00-33.00
Rails, 18 in. and under	*43.00-44.00*
Rails, random lengths	*36.00-37.00*
Angles, splice bars	*36.00-37.00*

ST. LOUIS

(Brokers' buying prices)

No. 1 heavy melting	27.00
No. 2 heavy melting	25.00
No. 1 bundles	28.00
No. 2 bundles	18.00
No. 1 busheling	28.00
Machine shop turnings	7.00
Shovel turnings	9.00

Cast Iron Grades

No. 1 cupola	36.00
Charging box cast	33.00
Heavy breakable cast	31.00
Unstripped motor blocks	33.00
Clean auto cast	39.00
Stove plate	34.00

Railroad Scrap

No. 1 R.R. heavy melt.	28.00
Rails, random lengths	*36.00*
Rails, rerolling	44.00
Rails, 18 in. and under	*39.00*
Angles, splice bars	*35.00*

HOUSTON

(Brokers' buying prices; f.o.b. car)

No. 1 heavy melting	31.00-32.00
No. 2 heavy melting	29.00
No. 1 bundles	31.00-32.00
No. 2 bundles	18.00-19.00
Machine shop turnings	7.00-8.00†
Low phos. plate & structurals:	
3 ft	34.00
2 ft and under	36.00-37.00

Cast Iron Grades

No. 1 cupola	33.00-33.50
Heavy breakable	24.00
Foundry malleable	29.00-30.00†
Unstripped motor blocks	27.00-27.50

Railroad Scrap

No. 1 R.R. heavy melt.	32.00-33.00

LOS ANGELES

No. 1 heavy melting	34.00*
No. 2 heavy melting	30.00*
No. 1 bundles	28.00†
No. 2 bundles	22.00*
Machine shop turnings	12.00†
Shovel turnings	14.00†
Cast iron borings	12.00†
Cut structurals and plate 1 ft and under	41.00†

Cast Iron Grades

No. 1 cupola	35.00

Railroad Scrap

No. 1 R.R. heavy melt.	40.00†

PORTLAND, OREG.

(Prepared, f.o.b. car)

No. 1 heavy melting	36.00
No. 2 heavy melting	34.00
No. 2 bundles	19.00
Shovel turnings	13.00
Electric furnace bundles	46.00

Cast Iron Grades

No. 1 cupola	31.50
Heavy breakable	31.00
Unstripped motor blocks	31.00
Stove plate (f.o.b. plant)	18.00

SEATTLE

(Prepared, f.o.b. car)

No. 1 heavy melting	36.00
No. 1 (prepared for shears)	33.00
No. 1 hvy (unprepared)	33.00
No. 2 heavy melting	34.00
No. 2 hvy (unprepared)	30.00
No. 2 bundles	20.00
Shovel turnings	15.00
Electric furnace bundles	46.00

Cast Iron Grades

No. 1 cupola	31.50
Heavy breakable cast	33.00
Unstripped motor blocks	30.00
Stove plate (f.o.b. plant)	20.00

SAN FRANCISCO

No. 1 heavy melting	32.00
No. 2 heavy melting	29.00
No. 1 bundles	27.00-28.00
No. 2 bundles	18.00
Machine shop turnings	14.00
Mixed borings, turnings	14.00
Cast iron borings	14.00
Heavy turnings	14.00
Shovel turnings	14.00
Cut structurals, 3 ft	40.00

Cast Iron Grades

No. 1 cupola	46.00-48.00
Charging box cast	34.00
Stove plate	34.00
Heavy breakable cast	28.00
Unstripped motor blocks	31.00
Clean auto cast	40.00
Drop broken machinery	45.00-46.00
No. 1 wheels	34.00

HAMILTON, ONT.

(Brokers' buying prices; net tons)

No. 1 heavy melting	24.00
No. 2 hvy melt, 2 ft & under	22.50
No. 1 bundles	24.00
No. 2 bundles	17.00
Mixed steel scrap	16.00
Mixed borings, turnings	12.00
Busheling, new factory: Prepared	23.00
Unprepared	18.00
Shovel turnings	12.00

Cast Iron Grades‡

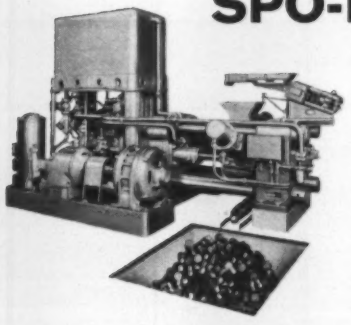
No. 1 machinery cast	30.00

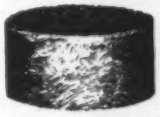
*For export add $4 dock charges.
†Nominal.
‡F.o.b. Hamilton, Ont.
§Delivered.

"Briquette this stuff and we can sell it at a profit!"

. . . with a

SPO-MILWAUKEE briquetting press!

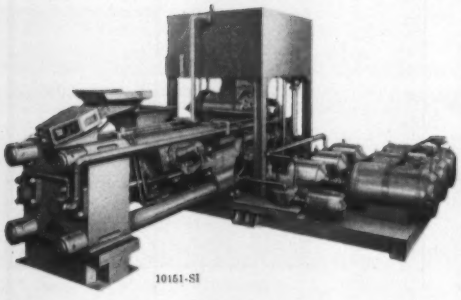




As the metal working industry increases machine tool speeds . . . as automation techniques facilitate faster production . . . more and MORE chips, turnings and borings are formed.

Briquetted scrap sells for more money . . . and this means a briquetting press is a profit making machine . . . a profit unit that operates virtually "operator-free." The advantages of briquetting go even beyond profit. Your scrap will require less storage area. Briquetted scrap is easier to handle . . . cheaper to ship . . . faster to dispose of.

If your machine tool scrap ranges from 4 tons per day to 9 tons per hour, there is a Milwaukee briquetting press that will bring profit to your scrap problem.



We strongly urge you to write today for Bulletin BP-217. It will provide you with all the facts. Send your inquiry to . . .

WORLD'S LARGEST SUPPLIERS SPO OF MOLDING MACHINES

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How the 1961 Markets Shape Up

Nonferrous Metal Prices, Pages 306 & 307

MOST major nonferrous metal producers are reluctant to get out on a limb in making forecasts for 1961. Reason: The one they perched on in predicting sales last year cracked and sent them tumbling.

Those who have dared to predict some improvement in the coming year admit they are relying more on hope than on solid market facts.

Majority opinion seems to shape up like this: Through the first half we'll see a continuation of weak prices, spotty demand, some overproduction (and probably production curtailments), and a virtual end to customer inventory workoff. The second half, believe producers, will be substantially better.

• **Aluminum** — Primary production will be lower. Output in 1960 set an all-time record of about 2,010,000 tons, but it was mainly because of overproduction based on bullish forecasts. Demand didn't justify it. If it hadn't been for record exports (250,000 tons), producers' stocks would be considerably higher than the present 225,000 to 250,000 tons.

Producers have been cutting back production over the last few months and STEEL estimates they are now operating at about 73 per cent of their 2.5 million ton a year capacity, or at an annual rate of about 1.8 million tons. It's unlikely rates will be upped much until the bulk of stocks are worked off. Translating all those factors into a 1961 production forecast, it looks like about 1,925,000 tons of primary metal will be turned out.

Aluminum shipments in 1960 totaled a respectable 2,350,000 tons, only 5 per cent under the record (2,480,000 tons in 1959). Consumption was even better because of customer stock workoff. The inventory reduction is about over but that gain will be somewhat offset by an expected decline in exports. Probable: A shift of not more than 2 to 4 per cent (either way) in shipments during 1961. One hedge: A sharp upturn in business could send sales spiraling since the industry traditionally rebounds faster than the economy.

• **Copper**—Refined metal deliveries to fabricators last year rose to about 1,285,000 tons, close to the 1959 figure of 1,312,328 tons. Most metalmen think they'll do well to match the 1960 mark this year even though customers who have been living off inventory will be forced into the market for metal. Copper's major customers—the brass and wire mills — see little, if any, gain in demand through the first half. Nevertheless, a few metalmen believe copper sales will rise 4 to 8 per cent.

Copper's major problem will continue to be the supply-demand imbalance. Free World refined stocks now stand at around 450,000 tons and those in the U. S. at about 145,000 tons. Some curtailments are possible. U. S. refined production should drop from the 1960 figure of about 1,675,000 tons to the area between 1,575,000 and 1,600,000 tons. The metal is statistically weak and odds are prices will move down rather than up over the short term.

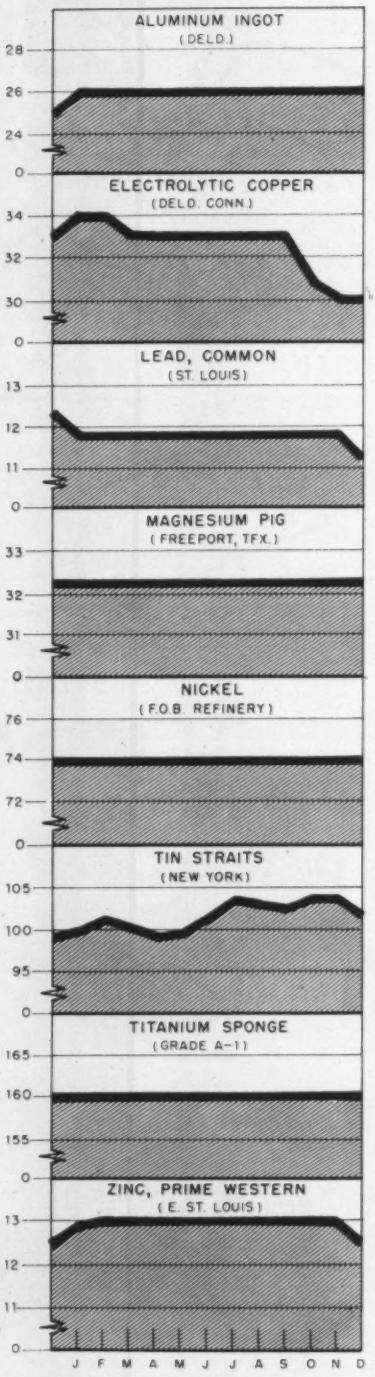
• **Lead-Zinc**—Sales for both metals will be a bit better this year if producer forecasts hold up, but they aren't expected to match those of 1959. Lead consumption (metal from all sources) dropped about 5 per cent in 1960 while primary pig shipments were off about 20 per cent. Slab zinc shipments dropped to around 832,000 tons from 1959's 894,000 tons. Customer inventory workoff is about over, which should help 1961 sales for both metals.

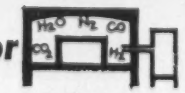
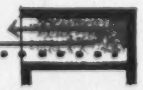
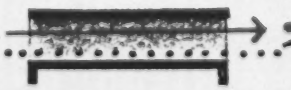
Producers' stocks are too high, particularly in lead. Prices aren't strong and metalmen are fearful they will go lower unless production curtailments are made both here and abroad. Slab zinc output this year is estimated at around 850,000 tons compared with 860,000 tons in 1960.

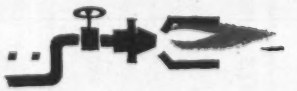
Lead production should about match last year's figure.

What Prices Did in '60

(Cents per pound)



IF you want to **HEAT** metal . . . . (melting, forging, brazing, sintering or treating) . . . . ferrous, nonferrous or exotic . . . . whether your parts travel one at a time in batches or in droves in a straight air atmosphere . . . . or in a protective atmosphere or  an upgrading atmosphere in & out  down & up straight through 

or in a combination with manual operation or automatic AND if you want the economy of standard equipment the least costly fuels . . .  PLUS known production rates and pre-rated operating costs WHAT DO YOU NEED? (pit, pot, box, link, muffle, tube, snap or lab furnace)

. . . SURFACE MAKES IT!

Write for Bulletin SC-175. Surface Combustion, 2385 Dorr St., Toledo 1, Ohio.
In Canada: Surface Industrial Furnaces Ltd., Toronto, Ontario.

A division of Midland-Ross Corporation MR

Surface®

Nonferrous Metals

Cents per pound, carlots except as otherwise noted.

PRIMARY METALS AND ALLOYS

Aluminum: 99.5%, 50 lb ingots, 26.00, 30,000 lb or more, f.o.b. customer custody.

Aluminum Alloy: No. 13, 25.90; No. 43, 26.20; No. 195, 27.60; No. 214, 31.50; No. 356, 26.80, 50 lb ingots.

Antimony: R.M.M. brand, 99.5%, 29.00; Lone Star brand, 29.50, f.o.b. Laredo, Tex., in bulk. Foreign brands, 99.5%, 26.25-26.75, New York, duty paid, 10,000 lb or more.

Beryllium: 97% lump or beads, $70.00 per lb, f.o.b. Cleveland or Reading, Pa.

Beryllium Aluminum: 5% Be, $65 per lb of contained Be, with balance as Al at market price, f.o.b. shipping point.

Beryllium Copper: 3.75-4.75% Be, $43 per lb of contained Be, with balance as Cu at market price on shipment date, f.o.b. shipping point.

Bismuth: $2.25 per lb, ton lots.

Cadmium: Sticks and bars, $1.60 per lb deld.

Cobalt: 99+%, $1.50 per lb for 500-lb keg; $1.52 per lb for 100 lb case; $1.57 per lb under 100 lb.

Columbium: Powder, $55 per lb and up nom.

Copper: Electrolytic, 30.00 deld.; custom smelters, 30.00; lake, 30.00 deld.; fire refined, 29.75 deld.

Germanium: First reduction, ingots, less than 1 kg, 36.00-37.50 per gram; 1-10 kg, 30.50-32.00 per gram; 10 kg or more, 28.10-29.99 per gram; intrinsic grade, under 10 kg, 31.95 per gram; 10 kg or more, 29.95 per gram.

Gold: U. S. Treasury, $35 per oz.

Indium: 99.9%, $2.25 per troy oz.

Iridium: $70-75 per troy oz nom.

Lead: Common, 10.80; chemical, 10.90; corroding, 10.90, St. Louis. New York basis, add 0.20.

Lithium: 1 lb or 2 lb ingots, less than 24 lb, $11 per lb deld.; 24-99 lb, $9.50; 100-499 lb, $9.25; 450 lb or more, $9 per lb, delivered.

Magnesium: Pig, 35.25; ingot, 36.00 f.o.b. Velasco, Tex., 1.3 in. diam. x 12 in. sticks, 57.00 f.o.b. Madison, Ill.

Magnesium Alloy: AZ91A (diecasting), 40.75; AZ63A, AZ92A, AZ91C (sand casting), 40.75, f.o.b. Velasco, Tex.

Mercury: Open market, spot, New York, $208-210 per 75 lb flask.

Molybdenum: Unalloyed forging billets, 4.125-8.5 in. diam., 50-4999 lb, $8.15-11.50 per lb, depending on quantity; 5000 lb or more, $8 per lb, f.o.b. Coldwater, Mich.

Nickel: Electrolytic cathodes, briquettes, sheets (4 x 4 in. and larger), unpacked, 74.00; 10-lb pigs, unpacked, 78.25; "XX" nickel shot, 79.50; "F" nickel shot for addition to cast iron, in kegs, 74.50; "F" nickel, 5 lb ingots, 75.50. Prices f.o.b. Port Colborne, Ont., including import duty. New York basis, add 1.01; Exton, Pa., basis, add 1.60. Nickel oxide sinter at Buffalo, New York, or other established U. S. ports of entry, contained nickel, 69.60.

Osmium: $70-90 per troy oz nom.

Palladium: $24-26 per troy oz.

Platinum: $82-85 per troy oz from refineries.

Radium: $16-21.50 per mg radium content, depending on quantity.

Rhodium: $137-140 per troy oz.

Ruthenium: $55-60 per troy oz.

Selenium: $6.50-7 per lb, commercial grade.

Silver: Open market, 91.375 per troy oz.

Sodium: Solid pack, c.l., 1950; l.c.l., 20.00; brick, c.l., 21.00; l.c.l., 21.50; tank car, 17.00.

Tantalum: Melting stock, $35 per lb; rod, $60 per lb nom; sheet, $55 per lb nom.

Tellurium: $3.50-5 per lb, 100 lb or more.

Thallium: $7.50 per lb.

Tin: Straits, N. Y., spot, 101.625; prompt, 101.50.

Titanium: Sponge, 99.3+% grade A-1, ductile (0.3% Fe max.), $1.60 per lb; grade A-2 (0.5% Fe max.), $1.50 per lb.

Tungsten: Powder, 98.8%, carbon reduced, 100-lb lots, $2.75-2.85 per lb nom., f.o.b. shipping point; less than 1000 lb, add 15.00c; 99+% hydrogen reduced, $3.10-4.00.

Zinc: Prime western, 12.00; brass special, 12.25; intermediate, 12.00, East St. Louis, freight allowed over 0.50 per lb, New York basis, add 0.50. High grade, 13.35; special high grade, 13.50 deld. Die casting alloy ingot No. 3, 15.00; No. 2, 15.50; No. 5, 15.25 deld.

Zirconium: Reactor grade sponge, 100 lb or less, $8-8.50 per lb; 100-500 lb, $7.25-7.50 per lb, 500-1000 lb, $6.50-7.25; over 1000 lb, $6.50 per lb.

(Note: Chromium, manganese, and silicon metals are listed in ferroalloy section.)

SECONDARY METALS AND ALLOYS

Aluminum Ingot: Piston alloys, 25.00-26.00; No. 12 foundry alloy (No. 2 grade), 22.75; 5% silicon alloy, 0.60 Cu max., 24.00; 13 alloy, 0.60 Cu max., 24.00; 195 alloy, 25.75; 108 alloy, 23.25. Steel deoxidizing grades, notch bars, granulated or shot: Grade 1, 23.75; grade 2, 22.50; grade 3, 21.50; grade 4, 21.00.

Brass Ingot: Red brass, No. 115, 28.25; tin bronze, No. 225, 38.00; No. 245, 32.50; high-leaded tin bronze, No. 305, 32.75; No. 1 yellow, No. 405, 23.50; manganese bronze, No. 421, 27.50.

Magnesium Alloy Ingot: AZ63A, 37.50; AZ91B, 37.25; AZ91C, 41.25; AZ92A, 37.50.

NONFERROUS PRODUCTS

BERYLLIUM COPPER

(Base prices per lb, plus mill extras, 2000 to 5000 lb; nom. 1.9% Be alloy.) Strip, $1.945, f.o.b. Temple, Pa., or Reading, Pa.; rod, bar, wire, $1.945, f.o.b. Temple, Pa.

COPPER WIRE

Bare, soft, f.o.b. eastern mills, 20,000-lb lots, 35.35; l.c.l., 35.98. Weatherproof, 20,000-lb lots, 36.30; l.c.l., 37.05.

LEAD

(Prices to jobbers, f.o.b. Buffalo, Cleveland, Pittsburgh.) Sheets, full rolls, 140 sq ft or more, $16.50 per cwt; pipe, full coils, $16.50 per cwt: traps and bends, list prices plus 30%.

TITANIUM

(Prices per lb, 10,000 lb and over, f.o.b. mill.) Sheet and strip, $6.75-15.50; sheared mill plate, $5.25-9.00; wire, $5.55-9.50; forging billets, $3.20-4.75; hot-rolled and forged bars, $3.80-6.25.

ZINC

(Prices per lb, c.l., f.o.b. mill.) Sheets, 28.00; ribbon zinc in coils, 22.50; plates, 21.50.

ZIRCONIUM

Plate, $14.00-25.00; H.R. strip, $14.00-22.90; C.R. strip, $16.00-35.00; forged or H.R. bars, $11.00-17.40.

NICKEL, MONEL, INCONEL

	"A" Nickel	Monel	Inconel
Sheets, C.R.	138	120	138
Strip, C.R.	124	108	138
Plate, H.R.	130	110	126
Rod, Shapes, H.R.	107	89	109
Seamless Tubes	157	129	200

ALUMINUM

(Selected products and sizes)

Flat Sheets: 1100, 3003, and 5005, mill finish, 30,000 lb base f.o.b. customer custody.

Thickness Range (in.)	Width (in.)	Length Range (in.)	Price Range
0.250-0.136	24-72	72-180	45.40-48.00
0.136-0.096	24-72	72-180	45.90-48.80
0.096-0.077	24-72	72-180	46.40-50.30
0.077-0.068	24-72	72-180	46.90-52.10
0.068-0.061	24-72	72-180	46.90-55.00
0.061-0.048	24-72	72-180	47.40-57.70
0.048-0.038	24-72	72-180	47.90-60.50
0.038-0.030	24-72	72-180	48.40-65.30
0.030-0.024	24-72	72-180	48.90-67.20
0.024-0.019	24-60	72-180	49.40-59.90
0.019-0.017	24-48	72-144	50.30-57.00
0.017-0.015	24-48	72-144	51.20-58.00
0.015-0.014	24-36	72-144	52.30
0.014-0.012	24-36	72-144	53.50
0.012-0.011	24-36	72-144	54.60
0.011-0.0095	24-46	72-144	56.20
0.0095-0.0085	24-36	72-96	57.50
0.0085-0.0075	24-36	72-96	59.20
0.0075-0.007	24-36	72-96	60.80
0.007-0.006	24-36	72-96	62.50

ALUMINUM (continued)

Plates and circles: Thickness, 0.25-3 in.; width or diam., 24-60 in.; lengths, 72-240 in., mill finish.

Alloy	Plate Base	Circle Base
1100, 3003-F	44.60	50.90
5050-F	45.70	50.50
3004-F	46.70	52.40
5052-F	47.30	53.10
6061-T6	47.80	53.90
2024-T4*	51.80	58.90
7075-T6*	60.50	67.90

*24-48 in. width or diam., 72-180 in. lengths.

Screw Machine Stock: 30,000 base, 12 ft lengths

Diam	Round		Hexagonal	
(in.)*	2011-T3	2017-T4	2011-T3	2017-T4
0.125	74.90	77.30	....	....
0.188	63.20	63.20	....	80.10
0.250	60.00	62.60	72.70	74.10
0.375	59.20	63.80	71.00	72.00
	2011-T3	2017-T451	2011-T3	2017-T451
0.500	59.20	63.80	71.00	72.00
0.625	59.20	63.80	67.80	67.90
0.750	57.70	62.00	61.60	63.80
0.875	57.70	62.00	61.60	63.80
1.000	57.70	62.00	61.60	63.80
1.125	55.30	59.50	59.50	61.50
1.250	55.30	59.50	59.50	61.50
1.375	55.30	59.50	59.50	61.50
1.500	55.30	59.50	59.50	61.50
1.625	53.00	56.70	....	59.30
1.750	53.00	56.70	58.30	59.30
1.875	53.00	56.70	....	59.30
2.000	53.00	56.70	58.30	59.30
2.250	51.50	55.00	....	59.30
2.500	51.50	55.00	....	59.30
2.750	49.90	53.20	....	59.30
3.000	49.00	53.20	....	59.30
3.250	....	53.20	....	....
3.375	....	53.20	....	....

*Selected sizes.

Forging Stock: Round, Class 1, random length, diam., 0.375-8 in., "F" temper; 2014, 47.50-57.60; 6061, 43.50-57.60; 7075, 61.80-71.90; 7079, 66.80-76.90.

Pipe: ASA schedule 40, alloy 6063-T6, 3-40 ft lengths, plain ends, 90,000 lb base, dollars per ft. Nominal pipe sizes: 1 in., 32.00; 1¼ in., 43.40; 1½ in., 51.80; 2 in., 62.60; 3 in., 124.95; 4 in., 171.80; 5 in., 233.15; 6 in., 308.55; 8 in., 464.35; 10 in., 716.25 (3-24 ft lengths).

Factor	Alloy 6063-T5	Alloy 6062-T6
1-14	45.30-46.80	54.00-60.00
15-17	45.30-46.80	56.50-61.80
18-23	45.80-47.50	58.60-67.60
24-32	45.80-47.50	66.80-81.50
33-38	49.50-52.20	85.10-96.60
39-44	59.80-63.60	102.00-124.00

MAGNESIUM

Sheets and Plates: AZ31B standard grade, .032 in., 103.10; .081 in., 77.90; .125 in., 70.40; .188 in., 69.00; .250-2.00 in., 67.90. AZ31B spec. grades, .032 in., 171.30; .081 in., 108.80; .125 in., 98.10; .188 in., 95.70; .250-2.00 in., 93.30. Tread plate, 60-192 in. lengths, 24.72 in. widths; .125 in., 74.90; .188 in., 71.70-72.70; .25-.75 in., 70.60-71.60. Tooling plate, 0.25-3.00 in., 73.00.

Extruded Solid Shapes:

Factor	Com. Grade (AZ31C)	Spec. Grade (AZ31B)
6-8	65.30-67.60	84.60-87.40
12-14	65.30-67.60	85.70-88.00
24-26	66.10-68.40	90.60-91.30
36-38	71.50-75.30	104.20-105.30

NONFERROUS SCRAP

DEALERS' BUYING PRICES

Copper and Brass: No. 1 heavy copper and wire, 22.75-23.25; No. 2 heavy copper and wire, 21.00-21.50; light copper, 18.00-18.50; No. 1 composition red brass, 18.75-19.25; No. 1 com-

BRASS MILL PRICES

	MILL PRODUCTS a				SCRAP ALLOWANCES e (Based on copper at 30.00c)		
	Sheet, Strip, Plate	Rod	Wire	Seamless Tubes	Clean Heavy	Rod Ends	Clean Turnings
Copper	55.13b	52.36c	....	56.32	26.000	26.000	25.250
Yellow Brass	49.27	34.88d	49.56	53.43	20.375	19.625	18.625
Low Brass, 80%	51.75	51.69	52.04	55.81	22.500	22.250	21.750
Red Brass, 85%	52.62	52.56	52.91	56.68	23.250	23.000	22.500
Com. Bronze, 90%	54.03	53.97	54.32	57.84	24.000	23.750	23.250
Manganese Bronze	57.77-57.82	51.42-51.46	61.69	....	19.250	19.000	18.375
Muntz Metal	52.14	47.45	....	....	19.475	19.125	18.625
Naval Brass	54.08	47.89	60.39	58.24	19.125	18.875	18.375
Silicon Bronze	60.45-60.48	59.64-59.67	59.74-59.77	78.89	25.500	25.250	24.500
Nickel Silver, 10%	64.68	67.01	66.76	....	25.125	24.875	12.562
Phos. Bronze, A-5%	75.70	76.20	75.45	77.63	27.125	26.875	25.875

a. Cents per lb, f.o.b. mill; freight allowed on 50 lb or more. b. Hot-rolled. c. Cold-drawn. d. Free cutting. e. Prices in cents per lb for less than 20,000 lb, f.o.b. shipping point. On lots over 20,000 lb at one time of any or all kinds of scrap, add 1 cent per lb.

position turnings, 17.75-18.25; new brass clippings, 15.50-16.00; light brass, 12.50-13.00; heavy yellow brass, 13.50-14.00; new brass rod ends, 14.50-15.00; auto radiators, unsweated, 14.25-14.75; cocks and faucets, 15.25-15.75; brass pipe, 16.00-16.50.

Lead: Soft scrap lead, 7.25-7.75; battery plates, 2.25; linotype and stereotype, 8.00-8.50; electrotype, 7.00-7.25; mixed babbitt, 9.00-9.50.

Monel: Clippings, 23.00-24.00; old sheets 22.00-23.00; turnings, 16.50-17.50; rods, 22.00-23.00.

Nickel: Sheets and clips, 50.00-51.00; rolled anodes, 50.00-51.00; turnings, 39.00-41.00; rod ends, 50.00-51.00.

Zinc: Old zinc, 2.50-3.00; new diecast scrap, 3.75-4.00; old diecast scrap, 2.25-2.75.

Aluminum: Old castings and sheets, 11.00-11.50; clean borings and turnings, 6.00-6.50; segregated low copper clips, 13.00-13.50; segregated high copper clips, 12.00-12.50; mixed low copper clips, 12.50-13.00; mixed high copper clips, 12.00-12.50.

(Cents per pound, Chicago)

Aluminum: Old castings and sheets, 10.00-10.50; clean borings and turnings, 7.00-7.50; segregated low copper clips, 15.00-15.50; segregated high copper clips, 13.50-14.00; mixed low copper clips, 12.50-13.00; mixed high copper clips, 12.00-12.50.

(Cents per pound, Cleveland)

Aluminum: Old castings and sheets, 10.00; clean borings and turnings, 8.50; segregated low copper clips, 14.00; segregated high copper clips, 13.00; mixed low copper clips, 13.00; mixed high copper clips, 12.50.

REFINERS' BUYING PRICES

(Cents per pound, carlots, delivered refinery)
Beryllium Copper: Heavy scrap, 0.020-in. and heavier, not less than 1.5% Be, 56.00; light scrap, 51.00; turnings and borings, 36.00.

Copper and Brass: No. 1 heavy copper and wire, 24.00; No. 2 heavy copper and wire, 23.00; light copper, 21.00; refinery brass (60% copper) dry copper content, 22.00.

INGOTMAKERS' BUYING PRICES

Copper and Brass: No. 1 heavy copper and wire, 24.00; No. 2 heavy copper and wire, 23.00; light copper, 21.00; No. 1 composition borings, 19.50-21.25; No. 1 composition solids, 20.00-21.75; heavy yellow brass solids, 15.50-16.25; yellow brass turnings, 14.50-15.25; radiators, 16.00-16.75.

PLATING MATERIAL

(F.o.b. shipping point, freight allowed on quantities)

ANODES

Cadmium: Special or patented shapes, $1.60.

Copper: Flat-rolled, 47.04; oval, 43.50, 5000-10,000 lb; electrodeposited, 39.00, 2000-5000 lb lots; cast, 41.50, 5000-10,000 lb quantities.

Nickel: Depolarized, less than 100 lb, 114.25; 100-499 lb, 112.00; 500-4999 lb, 107.50; 5000-29,999 lb, 105.25; 30,000 lb, 103.00. Carbonized, deduct 3 cents a lb.

Tin: Bar or slab, less than 200 lb, 119.50; 200-499 lb, 118.00; 500-999 lb, 117.50; 1000 lb or more, 117.00.

Zinc: Balls, 19.25; flat tops, 19.25; flats, 22.00; ovals, 21.25, ton lots.

CHEMICALS

Cadmium Oxide: $1.60 per lb in 100-lb drums.
Chromic Acid (flake): 100-2000 lb, 31.00; 2000-10,000 lb, 30.50; 10,000-20,000 lb, 30.00; 20,000 lb or more, 29.50.

Copper Cyanide: 100-200 lb, 65.90; 300-900 lb, 63.00; 1000-19,000 lb, 61.90.

Copper Sulphate: 100-1900 lb, 15.25; 2000-5900 lb, 13.25; 6000-11,900 lb, 13.00; 12,000-22,900 lb, 12.75; 23,000 lb or more, 12.25.

Nickel-Chloride: 100 lb, 45.00; 200 lb, 43.00; 300 lb, 42.00; 400-4900 lb, 40.00; 5000-9900 lb, 38.00; 10,000 lb or more, 37.00.

Nickel Sulphate: 5000-22,999 lb, 29.00; 23,000-39,900 lb, 28.50; 40,000 lb or more, 28.00.

Sodium Cyanide (Cyanobrik): 200 lb, 23.80; 400-800 lb, 20.80; 1000-4900 lb, 19.80; 5000-19,900 lb, 18.80; 20,000 lb or more, 17.60.

Sodium Stannate: Less than 100 lb, 79.10; 100-600 lb, 69.70; 700-1900 lb, 67.00; 2000-9900 lb, 65.10; 10,000 lb or more, 63.80.

Stannous Chloride (Anhydrous): 25 lb, 154.40; 100 lb, 149.50; 400 lb, 147.10; 800-19,900 lb, 106.20; 20,000 lb or more, 100.10.

Stannous Sulphate: Less than 50 lb, 139.60; 50 lb, 109.60; 100-1900 lb, 107.60; 2000 lb or more, 105.60.

Zinc Cyanide: 100-200 lb, 59.00; 300-900 lb, 57.00.

(*Concluded from Page 301*)

Bookings totaled 240,347 tons, about 20,000 tons more than in the preceding month but 8 per cent below bookings in the same 1959 month. The total for the first 11 months was 2,988,001 tons.

November shipments amounted to 288,685 tons, down 8 per cent from the previous month's. It was the first month since May below the 300,000 ton mark. Total shipments during the first 11 months came to 3,190,020 tons.

Orders backlogs as of Nov. 30 stood at 2,016,062 tons. Of that total, 1,139,077 tons were scheduled for fabrication during the four months ending Mar. 31, 1961.

Structural Shapes . . .

Structural Shape Prices, Page 289

Except for the larger integrated structural fabricating shops, most fabricators enter the new year with small order backlogs. However, considerable pending work injects an optimistic note into the demand outlook for the next three or four months. Much of the steel for the jobs probably will be placed before spring.

Several Eastern states are understood to be expediting plans for the construction of bridges and other public works. Estimates of steel tonnage required will be taken early this quarter.

In general, structural steel sellers expect little change in market conditions until March or April when construction and roadbuilding programs will get underway.

STRUCTURAL SHAPES . . .

STRUCTURAL STEEL PLACED

6000 tons, transmission towers, Consolidated Edison Co., Poughkeepsie, N. Y., to American Bridge Div., U. S. Steel Corp., Pittsburgh.

1000 tons, fender structures, approaches to Throggs Neck Bridge, New York, through J. Rich Steers Inc., New York, to Elizabeth Iron Works Inc., Union, N. J.

500 tons, Lehigh Valley Shipping Center, Bethlehem, Pa., through All State Construction Co. to Lehigh Structural Steel Co., Allentown, Pa.

331 tons, bridge, FAI Route 74 over Route 150, Proj. I-IG74-4, Tazewell County, Ill., for State of Illinois, to Vierling Steel Works, Chicago.

311 tons, Glidden Point bridge, relocation Route 1, Newcastle-Damariscotta, Maine, to Bancroft & Martin Rolling Mills Co., South Portland, Maine; Cianchette Bros. Inc., Pittsfield, Maine, general contractor; 85 tons, concrete reinforcing bars to the same supplier.

248 tons, bridge, Project No. S458(2), Bedford, Ind., for State of Indiana, to Vierling Steel Works, Chicago.

209 tons, Holy Cross High School and residence, River Grove, Ill., to Vierling Steel Works, Chicago.

200 tons, building, Beaumont, Tex., through Singmaster-Breyer, New York, to Flint Steel Co., Tulsa, Okla.

STRUCTURAL STEEL PENDING

14,000 tons, facilities, Monthan Air Force Base, Arizona, J. A. Jones, Charlotte, N. C., low on the general contract.

7000 tons, Borgia-Butler housing development, New York Housing Authority, New York, bids Jan. 6.

1450 tons, eight highway structures, Rocky Hill-Wethersfield, Conn.; bids Jan. 3; also, 305 tons of steel piles required.

1340 tons, Carteret state interchange, Middlesex and Union couties, New Jersey, Public Constructors, Trenton, N. J., low on the general contract.

820 tons, state overpass, Route 208, Section 2C, Bergen County, New Jersey, Glenwal Co., low on the general contract.

815 tons, warehouse, Lionel Corp., Hillside, N. J., B. J. Lucurelli, low on the general contract.

808 tons, state bridgework, FICDE 60-5, Bronx County, New York, Tully & DiNapoli, New York, low on the general contract.

807 tons, state road work, RC 60-187, Delaware County, New York, John Arborio, Poughkeepsie, N. Y., low on the general contract.

800 tons, state bridgework, FIC 60-18 and FISH 60-19, Schenectady, N. Y., Weber Construction Co., New York, low on the general contract.

795 tons, warehouse, Goodyear Rubber Co., New Brunswick, N. J., H. K. Ferguson, New York, low on the general contract.

770 tons, Maxwell Locks, Army Corps of Engineers, Brownsville, Pa., Dravo Corp., Pittsburgh, low on the general contract.

635 tons, state bridgework, Route 413, Fairfax County, Virginia, Talbot Marks, a North Carolina contractor, is low bidder.

CLASSIFIED

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One #1 Late Model Buffalo or similar make Angle Roll with assorted attachments. Write or call

SAUDER TANK CO., INC.
220 Weaver St. Emporia, Kansas
Phone DI 2-2550
Robert A. Sauder, Vice President

Help Wanted

DEFENSE COMPANY NEEDS
Top man to set up and run new Forging Dept., making all type plumbing fittings—Steel, Stainless, Brass etc. Must be able to lay out plant and recommend correct Presses, also Hammers to buy. Send resume of experience to Bill Martin.
C & E FORGING CORPORATION
1710 W. Florence Ave., Inglewood, Calif.

Help Wanted

SALESMAN TO COVER CHICAGO TERRITORY selling mill and heavy industrial overhead traveling cranes. Respond to Box 893, STEEL, Penton Bldg., Cleveland 13, Ohio.

CLASSIFIED RATES

All classifications other than "Position Wanted" set solid, 50 words or less $20.00, each additional word, .40; all capitals, 50 words or less $23.00, each additional word .50; all capitals leaded, 50 words or less $28.00, each additional word .65. "Position Wanted" set solid, 25 words or less $5.50, each additional word .22; all capitals 25 words or less $7.50, each additional word .29; all capitals leaded 25 words or less $9.00, each additional word .35. Keyed address takes seven words. Cash with order necessary on "Position Wanted" advertisements. Replies forwarded without charge. Displayed classified rates on request. Address your copy and instructions to STEEL, Penton Building, Cleveland 13, Ohio.

NEW OSBORN POLISHING/BUFFING LATHES . . . these compact, variable speed lathes are Osborn-engineered to handle your work economically at highest efficiency. Available with balanced single or double spindles, fixed or variable speed ranges from 600 to 3600 rpm. Variable speed lathes have 3-to-1 speed range. Choice of 3, 5 or 7½ hp motors. Other features include: motor-mounted magnetic disc brakes for instantaneous spindle stopping. Roto-Cone drive for instant, vibration-free power transmission and speed changes.

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No. 3 Coil Preparation Line At Wheeling Steel Corporation's Yorkville Plant

Wean, Wheeling and Coil Preparation . . .

Inspecting and side trimming coils at high speeds, this Wean coil preparation line at Wheeling Steel Corporation represents another advance in the development of high speed processing lines. This new Wean line is designed to produce oiled black plate, or to prepare coils of various gauges for tinning and galvanizing. Capable of handling coil weights up to 42,000 pounds, the No. 3 Yorkville line can side-trim strip up to 45 inches in width and from .006 to .0359 in thickness.

Other new features of the Yorkville line are a butt-type shear-welder that produces a very smooth joint, minimizing distortion in the wraps of built-up coils; and a non-contact thickness gauge with indicating and recording instruments.

Wean's "creative engineering" has developed modern coil preparation lines that offer speeds of over 4,000 fpm, increased efficiency and higher prime product yield in subsequent coating operations. Wean experience in this field can be a valuable asset if coil preparation lines are part of your production planning.

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